R E P O R T   R E S U M E S

ED 018 945 EF 001 129

GUIDE FOR EDUCATIONAL PLANNING OF PUBLIC SCHOOL BUILDINGS AND SITES IN MINNESOTA, 1966 EDITION.

BY- TOLLERUD, GUY D.
MINNESOTA STATE DEPT. OF EDUCATION, ST.PAUL
REPORT NUMBER V-A-2(REV-66) PUB DATE 66
MINNESOTA STATE DEPT. OF ADMINISTRATION, ST. PAUL
EDRS PRICE MF-$0.75 HC-$7.88 195P.

DESCRIPTORS- *EDUCATIONAL PLANNING, *FACILITY GUIDELINES, *PUBLIC SCHOOLS, *SCHOOL BUILDINGS, *SCHOOL LOCATION, ELEMENTARY SCHOOLS, HEALTH, HEATING, LIGHTING, SCHOOL SAFETY, STRUCTURAL BUILDING SYSTEMS, VENTILATION,

A DETAILED GUIDE FOR PLANNING SCHOOL BUILDINGS AND SITES IN MINNESOTA. PART ONE DEALS WITH PROCEDURES IN SCHOOL PLANT PLANNING IN TERMS OF STATE AND LOCAL RESPONSIBILITIES. PART TWO DISCUSSES PLANNING AND DEVELOPING OF SCHOOL PLANT FACILITIES IN TERMS OF SCHOOL SITE, ELEMENTARY SCHOOL INSTRUCTIONAL FACILITIES, SECONDARY SCHOOL INSTRUCTIONAL FACILITIES, CENTRAL AND AUXILLIARY FACILITIES AND SERVICE FACILITIES. PART THREE EXAMINES SAFETY, HEALTH AND ENGINEERING IN CONSTRUCTING SCHOOL BUILDINGS IN TERMS OF FIRE AND LIFE SAFETY, STRUCTURAL DESIGN, SOUND CONTROL, LIGHTING AND FENESTRATION, PLUMBING DESIGN, SANITARY FIXTURES AND TRIM, HEATING AND VENTILATION, ELECTRICAL DESIGN, AND PREPARATION OF PLANS AND SPECIFICATIONS. INCLUDED ARE SEVERAL TABLES, FORMULAS, AND STANDARDS. THIS DOCUMENT MAY BE PURCHASED FROM THE DOCUMENTS SECTION, ROOM 140 CENTENNIAL BUILDING, ST. PAUL 1, MINNESOTA. PRICE IS $9.50. (RK)

GUIDE FOR DUCATIONAL PLANNING OF CHOOL BUILDINGS AND SITES IN MINNESOTA

SCHOOL PLANT PLANNING

STATE OF MINNESOTA
DEPARTMENT OF EDUCATION

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

Code V-A-2 (Rev. '66)

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

ED018945

GUIDE FOR EDUCATIONAL PLANNING OF PUBLIC SCHOOL BUILDINGS AND SITES IN MINNESOTA

1966 Edition

STATE COPY

EF001129

Distributed by

DOCUMENTS SECTION, STATE DEPARTMENT OF ADMINISTRATION
Room 140 Centennial Building, St. Paul, Minnesota 55101

MARGIN INDEX

Sections

PART I

1-19 STATE AND LOCAL RESPONSIBILITIES

20-39 PROCEDURES IN PLANNING AND CONSTRUCTING SCHOOL BUILDINGS

PART II

40-49 THE SCHOOL SITE

50-69 ELEMENTARY SCHOOL INSTRUCTIONAL FACILITIES

70-99 SECONDARY SCHOOL INSTRUCTIONAL FACILITIES

100-109 CENTRAL AND AUXILIARY FACILITIES

110-119 SERVICE FACILITIES

PART III

120-149 FIRE AND LIFE SAFETY

150-169 STRUCTURAL DESIGN

170-189 SOUND CONTROL

190-209 LIGHTING AND FENESTRATION

210-229—PLUMBING DESIGN AND SANITARY FIXTURES AND TRIM

230-259 HEATING AND VENTILATION

260-279 ELECTRICAL DESIGN

280-289 PREPARATION OF PLANS AND SPECIFICATIONS

CONTENTS

Guide for the Educational Planning of School Buildings and Sites in Minnesota

PART I

PROCEDURES IN SCHOOL PLANT PLANNING

Section
1-19 STATE AND LOCAL RESPONSIBILITIES
1.0 Purpose of the Guide
2.0 Powers and Duties of Local School Boards
3.0 State Board of Education, Supervisory and Regulatory Functions
4.0 State Department of Education, Administrative Functions
5.0 School Plant Planning Section, General Functions
  Services
  Duties and Responsibilities
  Policies
  Approval of Sites
  Approval of Plans and Specifications for School Buildings
6.0 Other State Agencies, Supervisory and Regulatory Functions
7.0 Responsibilities of Local School District Officials
8-19 Reserved for future use

Section
20-39 PROCEDURES IN PLANNING AND CONSTRUCTING SCHOOL BUILDINGS
20.0 Introduction
21.0 Determining the Communities Educational Needs
22.0 Selecting the Architectural and Engineering Services
23.0 The Preliminary and Planning Phase
24.0 Financing the Building Program
25.0 Development of Final Plans and Specifications
26.0 Construction of the Building
27.0 Putting the Building into Service
28.0 Contract Agreement
29.0 Certificate of Completion of School Building Construction
30-39 Reserved for future use

PART II

PLANNING AND DEVELOPING SCHOOL PLANT FACILITIES

Section
40-49 THE SCHOOL SITE
40.0 Selecting Sites, General Aspects
41.0 Criteria for Selecting Sites
42.0 Size of Sites
43.0 Site Development
44-49 Reserved for future use

50-69 ELEMENTARY SCHOOL INSTRUCTIONAL FACILITIES
50.0 Elementary Facilities, General
51.0 Elementary School Classrooms
52-53 Instructional Materials Center:
  Library
  Audio-Visual Education
54.0 Remedial Reading and Speech Correction Center
55.0 Elementary Music Rooms
56.0 Physical Education Unit
57.0 Multipurpose Rooms
58.0 School Lunch Facilities
59.0 Special Education
60-69 Reserved for future use

Section
70-99 SECONDARY SCHOOL INSTRUCTIONAL FACILITIES
70.0 Secondary School Facilities, General
71.0 General Classrooms
72-73 Instructional Materials Center:
  Library
  Audio-Visual Education
74.0 Modern Foreign Language Facilities
75.0 Science Facilities
76.0 Mathematics Laboratory
77.0 Art Education Laboratory
78.0 Music Unit
79.0 Industrial Arts Education
80.0 Trade and Industrial Education
81.0 Vocational Agriculture
82.0 Business Education
83.0 Distributive Education
84.0 Home Economics Education
85.0 Area Vocational-Technical School Facilities
86.0 Vocational Cooperative Training Programs
87.0 Physical Education and Health Unit
88.0 Driver Education
89-99 Reserved for future use

CONTENTS

Section
100-109 CENTRAL AND AUXILIARY FACILITIES
- 100.0 Administration Unit
- 101.0 Guidance Facilities
- 102.0 Health Center
- 103.0 Teachers Rooms
- 104.0 Student Activity Rooms and Centers
- 105.0 School Lunch Unit
- 106.0 Auditoriums and Stages

107-109 Reserved for future use

110-119 SERVICE FACILITIES
- 110.0 Mechanical-Electrical Equipment and Custodial Services
- 111.0 School Bus Garages

112-119 Reserved for future use

PART III

SAFETY, HEALTH AND ENGINEERING IN CONSTRUCTING SCHOOL BUILDINGS

Section
120-149 FIRE AND LIFE SAFETY
- 120.0 General
- 121.0 Types of Construction
- 122.0 Restrictions on Types of Construction
- 123.0 Rooms for Heating Plants
- 124.0 Stairways
- 125.0 Building Exits
- 126.0 Corridors
- 127.0 Interior Finish Ratings
- 128.0 Interior Doors
- 129.0 Seating and Aisles in Places of Assembly
- 130.0 Fire Alarm Systems
- 131.0 Fire Fighting Equipment
- 132.0 Building Gas Service Lines
- 133.0 Incinerators and Destructors
- 134.0 Hazardous Areas, Shops, Laboratories, Garages
- 135.0 Miscellaneous Fire Protective Features
- 136.0 Elevators for School Buildings
- 137.0 School Buildings, Usable by Physically Handicapped

138-149 Reserved for future use

150-169 STRUCTURAL DESIGN
- 150.0 Responsibility
- 151.0 Policy: Local Codes
- 152.0 Structural Design Standards
- 153.0 Soil Borings
- 154.0 Design Loads
- 155.0 Design Data To Be Scheduled
- 156.0 Fallout and Blast Shelters
- 157.0 Inspection During Construction
- 158.0 Signature on Structural Plans

159-169 Reserved for Future Use

170-189 SOUND CONTROL
- 170.0 General
- 171.0 External Sound
- 172.0 Internal Sound
- 173.0 Sound Absorption
- 174.0 Sound Transmission and Control
- 175.0 Acoustical Planning
- 176.0 Acoustical Treatment
- 177.0 Acoustical Design Standards
- 178.0 Critical Spaces

179-189 Reserved for future use

190-209 LIGHTING AND FENESTRATION
- 190.0 Responsibility
- 191.0 Lighting Standards
- 192.0 Lighting: Definitions, Terminology
- 193.0 Desirable Conditions
- 194.0 Electric Lighting Systems
- 195.0 Protection and Parking Lot Lighting
- 196.0 Daylighting and Daylight Control
- 197.0 Windows (Fenestration)
- 198.0 Windowless Classrooms
- 199.0 Ceiling Heights, Minimums

200-209 Reserved for future use

210-229 PLUMBING DESIGN AND SANITARY FIXTURES AND TRIM
- 210.0 General Requirements, New Buildings
- 211.0 Plumbing Code and Standards
- 212.0 Responsibility for Design
- 213.0 Water Supply
- 214.0 Sewage Disposal
- 215.0 Building Gas Service Lines
- 216.0 Toilet Rooms
- 217.0 Plumbing Fixtures and Trim
- 218.0 Heights, Plumbing Fixtures
- 219.0 Signature on Plumbing Drawings and Specifications
- 220.0 Certificate of Inspection of Plumbing Installation

221-229 Reserved for future use

230-259 HEATING AND VENTILATION
- 230.0 The Thermal Environment
- 231.0 Responsibility for Design
- 232.0 Definitions

CONTENTS

Section
233.0 References for Design Standards
234.0 Types of Heating and Ventilating Systems
235.0 Types of Heating Controls
236.0 Selection of Systems
237.0 Plans and Specifications
238.0 Performance Tests
239.0 Manual of Instructions for System
240.0 Design Temperatures
241.0 Recommended Heating and Ventilating Conditions
242.0 Boiler Rooms and Heating Equipment Rooms
243.0 Fuel Storage and Handling
244.0 Firing Equipment and Controls
245.0 Piping: Steam and Hot Water
246.0 Heating Units
247.0 Central Fan, Heat Pump and Air Conditioning Units
248.0 Temperature Controls
249.0 Thermal Comfort and Effective Teaching
250.0 Ventilation Design, General
251.0 Ducts, Dampers and Vent Duct Termination
252.0 Exhaust Systems
253.0 Signatures on Heating and Ventilating Plans
254-259 Reserved for future use

Section
260-279 ELECTRICAL DESIGN

260.0 Responsibility
261.0 Standards for Electrical Installation and Design
262.0 Electric Service to School Buildings
263.0 Electric Lighting Systems
264.0 Receptacles: Convenience and Power
265.0 Grounding and Power Control
266.0 Fire Safety Systems
267.0 Communication Systems
268.0 Signature on Electrical Plans
269.0 Review of Electrical Plans by State Board of Electricity
270.0 Certificate of Inspection
271-279 Reserved for future use

280-289 PREPARATION OF PLANS AND SPECIFICATIONS

280.0 Final Preliminary Drawings
281.0 Final Drawings
282.0 Specifications
283-289 Reserved for future use

STATE COMMITTEE FOR REVISION OF SCHOOL BUILDING GUIDE

EDUCATORS

District Superintendents and Administrators:

James V. Moon	Superintendent	Rochester
Geo. W. B. Eitreim	Superintendent	Winnebago
A. P. Bergee	Superintendent	Circle Pines
C. H. Mogck	Admin. Director	St. Cloud
Harold Enesvedt	Superintendent	St. Louis Park
Ray H. Witt	Superintendent	Bemidji

Senior High Principals and Administrative Personnel:

J. F. Kunze	Principal	Mounds View
Willis Boynton	Director of Secondary Education	Robbinsdale
Clifford Rykken	Secondary Curriculum Director	Alexandria

Junior High Principals:

Roland DeLapp	Anthony Junior High School	Minneapolis
Miss Charlotte Lehman	Portland Junior High School	Bloomington
Roy Isacksen	Como Park Junior High School	St. Paul

Elementary Principals and Administrative Personnel:

O. E. Hoyum	Supervisor of Elementary Schools	Cloquet
Miss June Otterness	Elementary Supervisor	Hutchinson
Warren Lee Lindquist	Principal: Earl Brown Elementary	Brooklyn Center
Miss Naomi A. Fausch	Principal: Shingle Creek Elementary	Minneapolis

School Board Members:

Gordon Blume	School Board*	Verndale
Herbert Latvala	School Board*	Nashwauk

*Representing the Minnesota School Boards Association.

State Department of Education:

Guy Tollerud	Director: School Plant Planning	St. Paul
Floyd Erickson	Assist. Dir.: School Plant Planning	St. Paul
Howard Hall	Consultant: Research Section	St. Paul

ARCHITECTS

Robert Ames	Court House	St. Paul
Gene Green	1111 Nicollet Avenue	Minneapolis
Richard F. Hammel	2675 University Avenue	St. Paul
Arthur Lucas	900 Alworth Bldg.	Duluth
Roger Patch	2801 Wayzata Boulevard	Minneapolis
Jarl Seppanen	818 First National Bank Bldg.	St. Paul
John Torseth	4901 Olson Memorial Highway	Minneapolis
Al Wegleitner	602 Prudential Bldg.	Minneapolis
Joseph J. Weichselbaum	104 Miracle Mile Office Building	Rochester
Education Committee, Minn. Society of Architects, A.I.A.	3416 University Avenue S.E.	Minneapolis

ENGINEERS

Mechanical:

John Baker	1835 University Avenue	St. Paul
Donald Campbell	1415 N. Lilac Drive	Minneapolis
Ray O. Jacobson, Jr.	1932 5th Avenue East	Hibbing

Electrical:

Herbert J. Frey	734 East Lake Street	Minneapolis
James A. Lang	250 Foshay Tower	Minneapolis
Norman Podas	1415 N. Lilac Lane	Minneapolis
Norman Knafla	5675 Westbrook Road	Minneapolis

Structural and Civil:

Mark B. Foss	28 Third Street North	Moorhead
Frank Frankosky	2815 Wayzata Boulevard	Minneapolis
John Sahlman	640 Sexton Bldg.	Minneapolis

STATE AGENCIES

State Board of Registration: Architects, Engineers, and Land Surveyors

Arnold Steffes	Chairman: Pioneer Building	St. Paul

State Board of Electricity:

Ray Conrath	1954 University Avenue	St. Paul
Sidney Sanford	1954 University Avenue	St. Paul
Fred G. Madison	1954 University Avenue	St. Paul

State Fire Marshal:

Eugene L. Weber	State Office Building	St. Paul
Charles Berg	State Office Building	St. Paul

State Department of Health:

Elmer Huset	University Campus	Minneapolis
Arnold H. Bonifas	State Office Building	St. Paul

State Department of Labor and Industry: (Accident Prevention Division)

Roman Rutherford	State Office Building	St. Paul

PREFACE

Public boards of education because of authority granted to them by state statutes and as representatives of the people carry considerable responsibility in providing an adequate educational program for the children and youth of their school districts. In planning an educational program and its supporting facilities, an imperative consideration must be the basic needs of all youth and the incorporation of these broad interests with those of the local community. Each public school, therefore, should be reasonably complete and comprehensive in its program and services and be maintained on a standard of high quality.

An educational program can only be effectively organized and administered if adequate and suitable physical school plant facilities are available. It is, therefore, encumbent upon the board to provide suitable school sites and buildings to enable the teaching staff to function and execute the desired and essential educational program.

The school plant is a highly important instrument of education. Buildings and sites implement educational and service programs. Physical plant provisions are obviously closely related to the health, safety and comfort of pupils, teachers and other employees. Physical plant provisions can either facilitate or hinder the promotion of instructional and service activities and the attainment of educational objectives. It is extremely difficult if not impossible to provide an adequate and sound educational program without a comparable and adequate school plant.

The educational and service programs of public school are changing continuously. School buildings and sites that were once considered adequate are no longer suitable because of changes in the school program, school organization, and community service requirements.

Technological advances affect school planning and design. New materials and equipment, together with greater appreciation for the importance of good visual environment, acoustical treatment, and the need for designing functional and economical buildings, lead to the development of new approaches and practices in both planning and constructing school plant facilities.

Public school buildings are desired which are flexible and adaptable in design and well-suited to providing children with an effective education, present and future. Construction standards are recommended with aim at economy over the useful life of the buildings.

It is hoped that this manual will serve in promoting continued soundness in school plant planning. It is hoped, too, that it will support the process of continual up-grading of physical plant provisions and practices in planning and constructing school facilities.

Guy O. Tollerud, Director
School Plant Planning Section
State Department of Education

PART I

PROCEDURES IN SCHOOL PLANT PLANNING

SECTIONS 1-19. STATE AND LOCAL RESPONSIBILITIES IN SCHOOL PLANT PLANNING

Section

1.0 PURPOSE OF GUIDE. It is the purpose of this Guide to provide a manual for Minnesota school boards, school administrators, architects, engineers and others engaged in the various phases of developing a school plant program, including the planning, financing and construction of school buildings.

2.0 POWERS AND DUTIES OF LOCAL SCHOOL BOARDS

a. Although public education is basically a function of the state, the legislature has delegated certain phases of this function to local school districts and their school boards.

b. Within statutory limitations, the local school board may: (1) acquire sites for school buildings, erect school buildings, and provide for enlargements or additions to school buildings, (2) levy annually a capital expenditure tax and establish a fund in which the proceeds of the tax may be accumulated and may be expended to acquire, improve and repair school sites, and to erect, equip, improve or repair buildings and fixtures. When authorized by the voters of the district, the board may incur indebtedness to provide school buildings and sites by the issue of bonds of the district. See M.S.A. sections 123.36, 124.04, and M.S.A. Chapter 475.

c. The responsibility for acquiring school sites, providing funds for school plants and constructing school buildings is primarily a responsibility of the local school district and its elected school board, the state retaining certain supervisory and regulatory authority.

3.0 STATE BOARD OF EDUCATION. The supervisory and regulatory functions of the State Board of Education in respect to school buildings and sites are expressed in the statutes as follows:

> M.S.A. 121.15 PLANS AND SPECIFICATIONS FOR SCHOOL BUILDINGS. "The state board shall prescribe rules for school sites and for the mechanical equipment, erection, enlargement, and change of school buildings. All plans and specifications for the erection, enlargement, and change of school buildings shall first be submitted to the state department of education for approval before the contract is let and no new school buildings shall be erected or any building enlarged or changed until the plans and specifications have been submitted to, and approved by, the state department.# The state board shall include in such rules those made, from time to time, by the state board of health relative to sanitary standards for toilets, water supply, and disposal of sewage in public school buildings. In all other respects the authority to make rules for public school buildings shall be vested in the state board. The state board in approving construction plans may specifically qualify its approval as limited solely to physical plant, plans and specifications and it may specifically reserve its approval as to the advisability of construction from an educational program standpoint. Under such rules and procedures as the state board shall prescribe, the state department may condemn school buildings and sites which are unfit or unsafe to use as such."

Section

3.1 State Board of Education Regulations. Board regulations relating directly to school buildings and sites are as follows:

SCHOOL BUILDINGS AND SITES*

> "Edu 420. **Buildings and Sites, General.** To obtain the approval by the commissioner of education of plans and specifications, the following requirements of the State Board of Education shall be complied with.
>
> "Edu 421. **Schoolhouse Plans, Submission and Approval**
>
> "(a) Plans and specifications for the erection, betterment, enlargement or remodeling of a school building required to be submitted to the Commissioner of Education in accordance with Extra Session Laws 1959, Chapter 71, Article II, Section 15 (M.S.A. 121.15) shall be submitted in accordance with the procedure set forth by the Commissioner of Education.
>
> "(b) When approved, one set of plans shall be placed on file in the Department of Education and the other returned to the school board concerned, with the approval endorsed thereon.
>
> "(c) Minor changes in approved plans and specifications made either before or after contracts are let, shall conform to the recommendations of the State Board of Education stated in the Guide for Educational Planning of Public School Buildings and Sites; all major changes shall be approved by the Commissioner of Education before they become effective.
>
> "(d) Approval of plans and specifications by the Commissioner of Education shall be held as effective for a period of one year only, after the date of approval, provided a construction contract has not been awarded.
>
> "(e) Upon the completion and acceptance of a new school building, repair, enlargement or remodeling thereof, the school board shall certify to the Commissioner of Education, in a manner set forth by the Commissioner, that said new building, repair, enlargement, or remodeling thereof, was constructed and completed in accordance with the approved plans and specifications.
>
> "Edu 422. **Sites.** In the selection of a school site, the school board shall be guided by the suggested criteria for school site selection stated in the Guide for Educational

---

#When plans are not so submitted, any payment on a contract authorized and made by school district officials is an illegal order, and each such official shall forfeit to the district *twice* the amount of such illegal order upon action by any freeholder of the district. See M.S.A. 127.11.

*Minnesota Administrative Rules and Regulations. Rules and Regulations of The State Board of Education. 1964 Edition. Documents Section, Department of Administration, Room 140 Centennial Building, St. Paul, Minnesota 55101.

Section

Planning of Public School Buildings and Sites; and during the period of consideration of a site, before a contract for its purchase is made, the school board or its representative(s) shall confer with the Commissioner, in a manner set forth by him, on the educational adequacy of the site and its suitability for sound school construction and maintenance.

"**423. Facilities.** There shall be provision for instructional areas adequate and sufficient to carry out the educational requirements mandated by statute or by the regulations of the State Board of Education, such as standards for classification.

"**424. Construction.** Construction details shall conform to accepted good practice for public school buildings. Structural design, plumbing and sanitary facilities, heating and ventilation, electrical work, and provision for visual and auditory comfort and efficiency shall reasonably conform to the recommendations of the State Board of Education stated in the Guide for Educational Planning of Public School Buildings and Sites.

"**Edu. 425. Fire Safety**

"(a) Exits, stairs, and corridors shall be so placed and spaced as to permit ease of pupil circulation in the building and to insure ready escape from the building in case of emergency.

"(b) Fire protective features of the school buildings, such as types of construction, exits, stairs, corridors, fire alarm system, fire fighting equipment, boiler and furnace rooms, and installation of incinerators and destructors must comply with the Fire Safety Code of the State Fire Marshal."

Note: Sections 120-149 of the building Guide contain the Fire Safety Code.

3.2 Additional Board Regulations. Some examples of additional board regulations having a bearing on school building planning are the following:

"**Edu 2. Building**

"(a) A school district seeking to have a school classified shall provide a school building and site that are safe and healthful, adequate in size, and provide the necessary facilities for a school of the type for which the classification is sought.

"(b) A classified school, to maintain its classification status, shall remedy physical plant deficiencies resulting from (1) changes in or additions to physical plant standards, (2) increases in school enrollment, (3) change in educational program or services, or (4) changes necessary to correct unsatisfactory operational and maintenance practices."

"**Edu 3. Equipment**

"(a) General requirement. All classified schools shall be supplied with teaching facilities—textbooks, reference materials, library books, audio and visual aids and equipment, laboratory and shop equipment, furniture and supplies—of sufficient quality and quantity to carry on effectively the work of the school. All equipment shall be kept in good repair."

Section

"**Edu 4. Curriculum**

"(a) The educational program. The educational program shall be such as to provide a program of general education for all pupils and suitable **special education** for exceptional children—handicapped, gifted, and talented. It shall meet the needs and interests of all pupils and the needs of the community served.

"(b) Guidance. Each school shall provide **guidance** to assist pupils in making satisfactory personal adjustments and appropriate educational and vocational plans."

"**Edu 6. Library**

"(c) Library quarters. There shall be a well-equipped central library room, of a size appropriate to the enrollment, **in every graded elementary and secondary school building, plus, in all new school buildings,** the auxiliary space and facilities needed for work storage, viewing, listening and conference purposes. In one and two-room ungraded elementary schools, provision shall be made for a library alcove or corner."

"**Edu 7. Records and Reports**

"(b) Permanent records. Each school district shall keep accurate and complete individual, permanent, cumulative personal records for all pupils and shall store these records **in a fireproof file or vault.**"

"**Edu. 23. Staff** (Elementary Schools)

"(b) Teacher-pupil load. An acceptable maximum class size for instruction in any elementary classroom is 30 pupils. . . ."

"**Edu 40 Program of Studies** (Secondary Schools)

"(b) Junior secondary school. Each junior secondary school shall provide general education for all pupils; special education for exceptional children; exploratory experiences in the practical and fine arts fields, including provision for industrial arts or agriculture, home economics, music and art; library and audio-visual aids; and a planned guidance program.

"(c) Senior secondary school. Each senior secondary school shall provide a comprehensive program of studies which offers choices from the areas of general education and such specialized areas as college preparatory, vocational education, practical and fine arts to such extent as meet the needs of the pupils enrolled; special education for exceptional children; and a planned guidance program.

"(d) Six-year secondary school. Each six-year secondary school shall provide a program for the junior and senior secondary school periods which includes, in addition to the basic general and special education programs, pupil activities, well-planned guidance, audio and visual aids, library service, and work in at least **three approved departments. These departments shall be business education, home economics, and either industrial arts or agriculture.**"

"(h) Requirements, larger schools in special fields. Secondary schools with enrollments of 300 or more pupils shall offer work in all of the special fields of agriculture, industrial arts, home economics, and business education if local conditions warrant." (Agriculture, for example, would not be required in urban schools.)

Section

"Edu 46. **Staff** (Secondary Schools)

"(c) (3). The total pupil load for a (secondary school) teacher shall not exceed 160 pupils per day, exclusive of classes in physical education and applied music. The total pupil load per teacher under team teaching or similar arrangements shall not exceed an average of 160 pupils per day per week. (This allows for flexibility in classroom size.)

"(c) (4) An acceptable class size for instruction in agriculture, home economics and industrial arts shall not exceed 28 pupils and in no instance shall be greater than the number of pupil stations provided."

"Edu 162. **Secondary Schools** (Physical Education Instruction and Training)

"(c) Class size. An acceptable class size for instruction in physical education shall not exceed 40 pupils."

NOTE: The complete statement of Rules and Regulations of the State Board of Education is contained in the publication referred to in the footnote, page 1.

4.0 THE STATE DEPARTMENT OF EDUCATION

a. The Commissioner of Education is the executive officer for the State Board of Education and administers the State Department of Education in keeping with broad general policies of the board for the general supervision of the public school system of the state and in accordance with the laws of Minnesota.

b. Standards of the State Board of Education in respect to school building construction are formulated and consultative service provided through the State School Plant Planning Section. This is done with a view to securing for the public school children of Minnesota, safe, healthful, and functional school buildings in which proper consideration is given by local school boards to their planning, construction, mechanical equipment, operation, and maintenance.

5.0 SCHOOL PLANT PLANNING SECTION. Within the State Department of Education, the administration of school plant planning services is delegated to the School Plant Planning Section whose Director, in exercising this responsibility, utilizes the resources of the Department.

5.1 SERVICES

a. The School Plant Planning Section, with the aid of department consultants, offers consultative assistance:

(1) In the planning and organizing of community and school plant surveys, including a review of the results in terms of immediate and long term community needs.

(2) In evaluating and developing long range educational programs as a basis for planning new school plants, often for districts enlarged through reorganization.

(3) In developing educational specifications for new school plants based upon national, state, and local community needs.

(4) In developing major steps and procedures for conducting a successful school plant construction program and the financing of the program.

b. Maintains a file of public school building plans and specifications, cost data, and statistics relating to public school plant projects.

Section

c. Through conferences, workshops, and correspondence advises school officials, architects, and laymen on matters related to site planning and school construction.

d. Prepares and distributes bulletins and manuals of standards helpful to local school officials, professional school planners, and laymen.

5.2 DUTIES AND RESPONSIBILITIES

a. Reviews and approves final **preliminary drawings** for new school buildings, additions, or alterations to existing buildings.

b. Examines and approves final **working drawings and specifications** for new school buildings, additions, or alterations to existing buildings.

c. In cooperation with the State Department of Health, the State Department of Labor and Industry, and the State Fire Marshal: recommends to the Commissioner of Education, following survey, that action be taken to condemn school buildings and sites which are unsafe and unfit for use.

5.3 POLICIES

a. PRIVATE AND PAROCHIAL SCHOOLS. It is the established practice of the State School Plant Planning Section to offer consultative services on physical school plant specifications to architects and officials of private and parochial schools.

b. REVIEW OF TENTATIVE PLANS. It is the policy of the State School Plant Planning Section to reserve comment upon the fitness or acceptability of any school building plan until the architect or engineer has been commissioned for the project.

c. SCOPE OF "APPROVAL OF PLANS." In its examination and approval of plans, the Section is primarily concerned that the plans presented provide for the health and safety of pupils, adequacy and educational usefulness of buildings and sites, and that they reflect compliance with applicable Minnesota laws and regulations of the State Board of Education.

It DOES NOT assume responsibility for the architectural and structural design of any school building, the strength of materials used, or for the mechanical design or efficiency o heating, ventilating, plumbing and electrical systems. The registered architect and/or engineer retained for the work is legally responsible to the school board under the terms of his agreement with the school board. Approval of any plans and specifications should not be construed as an endorsement of any kind of materials, equipment, or special device shown on the plans or mentioned in the specifications. Approval of plans does not imply that the cost of construction will come within the estimated cost for which funds are provided.

d. APPROVAL OF PLANS NO PRECEDENT FOR FUTURE. Since educational programs, methods of instruction, practices in construction, development of new materials, and understanding of problems and procedures are subject to change, no decision of the Section in the approval of plans is to be considered a binding precedent in reviewing future plans. For the above reasons, the Director may exercise discrete judgement in the interpretation of the standards and recommendations stated in the Guide.

Section

5.4 Approval of Sites. In accordance with Minn. Reg. Edu 422, before a contract for the purchase of a site is made, the school board or its representative(s) must confer with the Director of School Plant Planning (the Commissioner of Education's representative) on the educational adequacy of the site and its suitability for sound school construction and maintenance.

5.5 APPROVAL OF PLANS AND SPECIFICATIONS FOR SCHOOL BUILDINGS

5.51 Preliminary Procedures

a. Before preliminary plans for any new building, addition to, or major alteration of an existing building are prepared, the school board, school administrator, and the architect, when commissioned, should contact the Director of the School Plant Planning Section for a thorough review of:

(1) The school district's long range educational and school plant plans; and

(2) Tentative educational specifications for the proposed new construction.

b. At this time there should also be considered:

(1) A site plan showing the dimensions and topographical features of the site;

(2) The location of the new construction and the location of existing buildings on the site; and

(3) In the case of additions and alterations, plans of the existing building, including the site.

5.52 Review of Preliminary Plans

a. Preliminary plans are developed by the architect from the educational specifications for each new building as outlined by the school staff and the state planning staff.

NOTE: Every school building designed should make the initial unit to be constructed as nearly a complete unit as practicable. The provision for future extensions should be definitely considered and indicated so that such future extensions will not require unnecessary future expenditures.

b. When the preliminary plans developed have been studied by the school building planning staff and/or committees and the school board and necessary modifications have been made by the architect, resulting in a final and acceptable preliminary plan, a review of this plan should be made with the state director of School Plant Planning. Taking part in this review should be the superintendent, architect, and as many members of the school board as can be present.

5.53 Submitting Final Plans and Specifications

a. After successful passage of the bond issue or the concluding of other steps required to meet financial needs, the architect should be directed by the board to proceed with refinements in the preliminary drawings and the drafting, within the budget, of final working drawings and specifications.

b. Two sets of complete drawings and specifications showing all details and describing fully all construction, materials and finish going into the building should be submitted by the school board through the architect to the state School Plant Planning Section for final approval. The scope of

Section

working drawings and specifications to be submitted should not be less than indicated in Sections 281 and 282, "Final Drawings and Specifications."

c. No changes, except minor changes not in conflict with standards and requirements, should be made in the drawings and specifications as finally approved by the state School Plant Planning Section, unless such changes are shown in revised drawings and specifications and are also approved. (See Minn. Reg. Edu 421 (c).)

d. Plans and specifications prepared and approved for one specific building may not be used for constructing another school building unless officially approved for the building by the state School Plant Planning Section.

e. Final approval of plans and specifications by the Commissioner of Education (School Plant Planning Section) will be held as effective for one year only after the date of approval, provided a construction contract has not been awarded. After that period has elapsed, the plans should be re-submitted for review and approval, considering the current existing conditions. (See Minn. Reg. Edu 421 (d).)

5.54 Certificate of Completion of School Building Construction. Upon the completion of construction and acceptance of a new building, addition, or major alteration of an existing building, the school board must certify to the Commissioner of Education that said new building, addition, or alteration has been constructed and completed in accordance with plans and specifications approved by the Commissioner of Education (School Plant Planning Section).

NOTE: The form for the certificate of completion is furnished by the state School Plant Planning Section.

6.0 SUPERVISORY AND REGULATORY FUNCTIONS OF OTHER STATE AGENCIES. The following state agencies, in addition to the State Department of Education, have some supervisory and/or regulatory functions in respect to the preparation of plans for school buildings and the construction of school buildings:

(1) State Department of Health

(2) State Fire Marshal's Office

(3) State Department of Labor and Industry

(4) State Board of Electricity

(5) State Board of Registration for Architects, Engineers and Land Surveyors

6.1 State Department of Health. The State Board of Health has regulations pertaining to the approval of plans for water supply, sewage disposal, plumbing and swimming pools where such facilities are for public use. The following regulations specifically require the submission of plans and specifications and their approval by the board.

> Reg. 200. "No system of water supply or system for the disposal of sewage, industrial waste, garbage or refuse in case any such system is for public use or for the use of a considerable number of persons, or in case any such system affects or tends to affect the public health in any manner, shall be installed by any public agency or by any person or corporation, nor shall any existing system be materially altered or extended, **until complete plans**

Section

and specifications for the installation, alteration, or extension, together with such information as the State Board of Health may require, **have been submitted in duplicate** and approved by the Board insofar as any features thereof affect or tend to affect the public health, and no construction shall take place except in accordance with the approved plans."

Reg. 277. "No system of plumbing for a building shall be installed, nor shall any such system be materially altered or extended by any person, corporation or public agency in case any such plumbing system is for public use or for the use of a considerable number of persons, or in case any such plumbing system affects or tends to affect the public health in any manner, **until complete plans and specifications** for the plumbing installation, alterations, or extensions, together with such information as the State Board of Health may require **have been submitted in duplicate** and approved by the Board insofar as any features thereof affect or tend to affect the public health, and insofar as these features conform to the Minnesota Plumbing Code, as amended. No construction shall take place except in accordance with approved plans. Provided that this regulation shall not apply to cities of the first class, except for plumbing installations in hospitals or in buildings in such cities owned by the Federal Government or State."

Reg. 285. "No swimming pool used or intended for use by the public or by any school, club, organization, or institution shall be constructed, nor shall any such swimming pool now or hereafter existing, used or intended for such use, be materially altered or enlarged until **complete plans and specifications** thereof, together with such further information as the State Board of Health may require, shall **have been submitted in duplicate** and approved by the Board so far as sanitary features are concerned. After the plans have been approved by the Board, no modification affecting the sanitary features thereof shall be made without the approval of the Board. No contract for the construction, alteration, or enlargement of any such swimming pool shall be written until the plans and specifications therefor have been approved as herein provided."

6.2 STATE FIRE MARSHAL'S OFFICE. The State Fire Marshal is required by law to review plans and specifications for school buildings in respect to making them usable by the physically handicapped and within 30 days of the receipt thereof to notify the submitting authority of his recommendations, if any. (Laws 1965 c 243 s 4). He is responsible for enforcing laws of the state relating to the prevention of fires and fire protection, the storage and use of combustibles, and means and adequacy of exits. He is authorized to make inspections of buildings any time "at reasonable hours" and to issue orders requiring fire hazards to be eliminated, or exits to be provided or kept open. He is also authorized to condemn and by order to direct the destruction, repair, or alteration of any building or structure which by reason of age, dilapidated condition, defective chimneys, defective electric wiring, gas connections, heating apparatus or other defect is especially liable to fire and which in his judgement is so situated as to endanger life or limb or other building or property in the vicinity.

Section

For these reasons and to save the school boards the expense of possible substantial and expensive alterations after construction, the state School Plant Planning Section will approve school buildings plans **only after they have been reviewed by the Fire Marshal's Office.** See Sections 120-149 in this GUIDE for the Fire Marshal's standards for the review of school building plans and the inspection of school buildings.

6.3 STATE DEPARTMENT OF LABOR AND INDUSTRY

a. The Accident Prevention Division of this state Department administers safety standards, laws and codes for the prevention of accidents and the preservation of health in places of employment. Its requirements govern the fencing, boxing, or otherwise protecting, of certain appliances and machinery that may constitute a hazard to safety of persons employed by the school board: the construction and ventilation of paint spray booths, the effectiveness of local exhaust ventilation in school kitchens and bus garages, safety in the installation and use of elevators in schools, sanitary provisions, and others insuring the safety and health of employees. For the above reasons, any aspects of mechanical plans in doubt in respect to such items should be reviewed by this division.

b. The Boiler Inspection Division of this same Department is responsible for annually inspecting all steam boilers and pressure vessels, and is authorized to charge a fee for doing so. However, when schools purchase boiler insurance and insurance companies make the inspection, a copy of the inspection report is accepted by the Boiler Inspection Division in lieu of the report of its own agent.

6.4 STATE BOARD OF ELECTRICITY. Has jurisdiction and is empowered to enforce the provisions of sections 326.24 to 326.32 of Minnesota statutes relating to electrical installations and licensing of electricians.

a. In accordance with M.S.A. 326.24 Subd. 2 and 326.32 Subd. 2, regular inspectors of the State Board of Electricity, or persons authorized to make inspections in designated areas, inspect electrical installation in any new construction or major remodeling or repair, except in cities of the first class and such other municipalities as have authorized inspection similar to that of the Board. The Board may condemn any installations not in compliance with statutory standards. It issues certificates as proof of compliance with statutory standards. Until such time as inspection can be made, proof of such compliance consists of an affidavit furnished by the contractor or other person making the electrical installation that there has been compliance with the law.

For the above reasons, and to save school boards substantial and expensive alterations after installations have been made, electrical plans should be reviewed by the State Board of Electricity. See sections 261, 269, and 270.

b. School boards should note that M.S.A. 326.25 and 326.26 provide that an electrical contractor must be licensed as a master electrician and such license must be covered by surety bond. No individual firm, co-partnership or corporation may engage in work as an electrical contractor unless it has a licensed master electrician in its employ. All bidders of electrical work must be properly licensed in Minnesota.

Section

6.5 STATE BOARD OF REGISTRATION FOR ARCHITECTS, ENGINEERS AND LAND SURVEYORS

a. PREPARATION OF SCHOOL BUILDING PLANS AND SPECIFICATIONS. In accordance with M.S.A. 326.03:

> "No person except an architect, engineer, or land surveyor, registered as provided for in sections 326.02 to 326.15 shall practice architecture, professional engineering, or land surveying, respectively, in the preparation of plans, specifications, reports, plats, or any other engineering or architectural documents, or in the supervision of architectural, engineering, or land surveying work for any public work or public improvement in this state, excepting any public work or public improvement the total cost of which does not exceed $2,000, provided that plans and specifications for such work or improvement affecting water supply or waste disposal are approved by the appropriate state agency. Public work or public improvement is defined to mean work or improvement the cost of which is to be paid in whole or in part from public funds. . . ."

b. CERTIFIED SIGNATURE ON PLANS AND SPECIFICATION. M.S.A. 326.12 Subd. 3 requires the certified signature of architect, engineer, or land surveyor as follows:

> "Each plan, specification, plat, report, or other document which sections 326.02-326.16 require to be prepared by a registered architect, registered engineer, or registered land surveyor shall bear the signature of the person preparing it, or the signature of the person under whose direct supervision it was prepared except for detailed or shop plans as exempt in section 326.02 Subd. 5. Each signature shall be accompanied by a certification that the signer is registered under Section 326.16. The provisions of this paragraph shall not apply to documents of an intra-office or intra-company nature."

c. BOARD OF REGISTRATION RULE AS TO SIGNATURE ON PLANS. The State Board of Registration in further interpreting section 326.12 Subd. 3 has promulgated the following rule as to signature on plans:

> Rule 21. "The certification and signature on plans, specifications, plats, reports, etc., is mandatory, as provided by Sec. 326.12, Subd. 3, M.S. 1953. A person in direct supervision of work as referred to in the foregoing subdivision is construed to mean the person whose professional skill and judgement are embodied in the document signed, and who assumes responsibility for the accuracy and adequacy thereof. . . ."

7.0 RESPONSIBILITIES OF LOCAL SCHOOL DISTRICT OFFICIALS

7.1 ROLE OF SUPERINTENDENT OF SCHOOLS. Some suggested duties of the school administrator in relation to the school plant program are:

(1) To anticipate school plant needs before a crisis occurs by maintaining and reviewing periodically appropriate school plant and enrollment projection data.

(2) To initiate an overall survey of the school system or of a school building at appropriate times, including recommendations to the board concerning the staffing of school plant studies.

(3) To assume responsibility for the survey, with advisory assistance, or if responsibility rests upon some outside agency employed to make the survey, to provide all essential information.

(4) Upon completion of the survey, and after consultation with the State School Building Planning Section and Division of Instruction, present to the board a summary report of survey recommendations, including a plan for achieving the desired educational program, building facilities to accommodate it, and a proposal for financing it.

(5) Initiate a proper study and analysis of the survey report by the school board, school staff and community at large. Recommend to the board the adoption, modification or rejection of each proposal in the report.

(6) Upon approval of the school plant program by the board, implement the educational specifications for each new building to be constructed; secure the necessary board approvals for actions which may be required.

(7) Recommend to the board procedures for the selection of an architect, emphasizing the value of bringing in the architect at an early date to assist in such matters as educational specifications, any proposed remodeling of existing buildings, and site selections.

(8) To the extent possible, see that all school building planning, including the selection of sites is coordinated with community planning of other local agencies, including the planning of local civil defense authorities in respect to emergency shelters in school buildings.

(9) To present to the board a long-term plan for acquisition of sites so that the board may purchase property when the cost is moderate. If a new site is to be acquired, assume the responsibility for appropriate procedures, including conferences with the State Director of School Plant Planning (a mandatory requirement) and the State Department of Health. When a site has been selected, secure authorization from the board to acquire the property.

(10) As the architect becomes involved in planning, furnish answers to questions which may arise in regard to educational specifications. When the preliminary sketches have reached the proper stage, secure tentative approval of them by the State School Plant Planning Section.

(11) After board approval of the preliminary drawings, with the assistance of the architect, prepare a project budget and secure analysis and approval by the board.

(12) With appropriate legal and bond specialist assistance, secure action by the board placing the issue of bonds to finance the school building program before the voters of the district.

(13) After the building bond issue has been approved by the voters, notify the architect in writing to proceed with working drawings and specifications for the new building. When satisfactory final working drawings and specifications have been developed and approved by the board, see that they are submitted to the State School Plant Planning Section as required by law. They must be so approved before any contracts are let. See M.S.A. 121.15 and M.S.A. 127.11.

(14) Secure action of the board resulting in the calling for bids in accordance with law for the proposed schoolhouse construction, utilizing the basic services of the architect and legal specialist during the time of bidding and in the preparation of the contract documents.

(15) During construction, receive from the architect and transmit to the board for approval all necessary change orders, requests for payment of construction, reports of progress, etc.

(16) See that the plumbing (electrical) contractor has furnished a copy of the final inspection certificate signed by an inspector of the State Board of Health (State Board of Electricity) to the board, the architect and the mechanical (electrical) engineer before final payment is made by the board.

(17) Upon completion of construction, arrange with the architect for a careful inspection of the building, and upon its successful completion, recommend acceptance by the board.

(18) See that the required Certificate of Completion is sent to the State School Building Planning Section.

(19) Initiate in-service training for staff in respect to use and operation of the building.

(20) Arrange for dedication ceremony, open house, and other ways of presenting and explaining the building to school patrons.

7.2 Role of School Board. The major functions of the local school board in relation to the school plant program are:

a. To be alert to school plant needs and, when there are needs, to call upon the superintendent or administrator for the development of a school plant program and essential data.

b. To grant the necessary authorizations and provide the necessary funds to permit progress at the successive stages

of the school building program. This includes the employment of architects and other specialists as required.

c. To act upon the various questions of educational policy raised during the period of determining the community's educational needs and during the planning stages.

d. To act upon the superintendent's recommendations and approve an official school plant program.

e. To approve the educational specifications for each new building.

f. To approve the necessary sites and provide for their acquisition.

g. To approve preliminary plans, the project budget, the financing program, and after the voters have authorized a bond issue for construction, the working drawing and specifications prepared by the architect for each new building or addition.

h. To secure approval of the final working drawings and specifications for each new building or addition by the State School Plant Planning Section of the State Department of Education and any other state agency whose approval is required by law.#

i. To authorize the calling for bids and to award construction contracts.

j. To approve change orders and authorize necessary payments during construction.

k. To formally accept the completed structure after final inspection and recommendation by the architect and superintendent.

l. To furnish the State School Plant Planning Section with a Certificate of Completion.

m. To staff the completed new building with appropriate custodial and mechanical-electrical maintenance personnel.

#See M.S.A. 121.15 and M.S.A. 127.11 "Drawing Illegal Orders."

8-19 Reserved for future use.

SECTIONS 20-39. PROCEDURES IN PLANNING AND CONSTRUCTING SCHOOL BUILDINGS

Section

20.0 INTRODUCTION. This section of the Guide contains material adapted from a brochure prepared by a joint committee representing the Minnesota School Board Association and the Minnesota Society of Architects, A.I.A. in consultation with the School Plant Planning Section, State Department of Education, published under the title, "Guide for Procedures in Planning and Constructing School Buildings."

(ANNOTATIONS. Following certain paragraphs in this section, annotations are added as a matter of additional information more pertinent to this type of manual. All "annotations" are so marked.)

a. Planning a school building and bonding a school district for an extended period of years is a serious matter. Constructing the facilities to house an appropriate educational program is an equally important responsibility. Therefore every effort must be made by all concerned to plan a facility that will be functional, effective, and economical in operation.

b. One of the first important steps to be considered whenever a new facility is needed, is to determine the basic facts which will serve as the basis for the planning of the building. Because of the importance of the preliminary work, sufficient time should be given to do a thorough and adequate job. Making preliminary surveys and studies may take from 3 to 12 months depending upon the scope of the project.

c. It is recommended that the school board retain an attorney to advise and assist them in preparing all legal and contract documents.

21.0 DETERMINING THE COMMUNITY'S EDUCATIONAL NEEDS. A school building provides the housing for the school population and the educational program. It is most advisable to reflect and analyze the community's educational needs in terms of enrollment and curriculum offerings.

21.1 PRESENT AND FUTURE ENROLLMENT TRENDS. Present enrollment constitutes a factor in the determination of a building program because it represents the pupils at hand that need schoolhousing. The present enrollment, however, is quite inadequate as a basis for determining needed future facilities unless the community is static—neither growing nor decreasing in school population. Because this is a growing state and nation, the problem of schoolhousing is usually due to ever-increasing school enrollments. For this reason future enrollment trends are more important than the present enrollment.

21.2 SCHOOL CENSUS. Minnesota Statutes require each school district to take a school census between August 1 and October 1 of each year. This census provides a relatively sound basis upon which to estimate future enrollments. Through a process of projection, future enrollments can be estimated at least six years in advance based on the number of pre-school children already living within the district. The effect and influence of parochial schools, if any, and their

Section

plans, must naturally be taken into account. Such factors as population movements into a community, residential and industrial expansion, population statistics and indicated trends, rural and suburban developments, and other factors should also be used in arriving at probable future enrollments.

21.3 SURVEYS—OUTSIDE AGENCIES

a. When a district is large, and when, especially, an area includes possibilities of further merging of school districts, an impartial outside survey agency should be used to make a complete survey and analysis of district organization, population and enrollment trends, financial resources, educational offerings and existing facilities. The Bureau of Field Studies of the College of Education, University of Minnesota, has the necessary experience and will, upon request, render this service to school districts under a contractual agreement. Such a survey may be of great value to a district having a complicated problem.

NOTE: The amount of a bond issue cannot be appropriately set after the survey. This can be done only after the school board has engaged an architect and the architect has prepared cost estimates in accordance with the preliminary plans being considered.

b. Factual data available through the census and/or surveys of outside agencies must then be carefully evaluated by the administration, the instructional staff together with the school board and usually a citizen's group to make a final recommendation of school plant needs.

21.4 PRESENT AND FUTURE CURRICULUM OFFERINGS AND TRENDS

a. Because a school building (or buildings) limits to a degree the curriculum offerings of a district, it is extremely important to re-evaluate and re-study the present curriculum offerings in terms of trends and future requirements. It is the curriculum and future enrollments that should determine the physical facilities and professional personnel needed.

b. Quite often there are recommendations and requirements set forth by the supervisory staff, under standards of the State Board of Education, which must be considered in planning new school facilities. Through a professional study made by the supervisory and teaching staff of the school, curriculum recommendations should be obtained. Recommendations of an informed local Citizen's Study Committee may be valuable. After a complete survey, analysis and evaluation of the curriculum, there should evolve recommendations which should be formulated into an educational plan to be presented to the school board for review and adoption. From this educational plan, the written educational specifications should be formulated for each proposed building or addition.

21.5 CONFERENCE WITH DIRECTOR OF SCHOOL PLANT PLANNING, STATE DEPARTMENT OF EDUCATION

a. The Minnesota State Constitution states that education is a primary responsibility of the state. The authority exercised by a local school board is granted to them by the state legislature. Considerable financial assistance for general maintenance purposes is distributed to school districts by the state. Each school system is an integral part of the state's system of education. The state legislature by statute requires plans and specifications for every school building, addition or change to be approved by the State Department of Education. To make it possible for the State Department to be of assistance in planning school facilities, one of the early procedures should be to arrange for a conference with the Director of School Plant Planning.

b. This conference involves an overview of the school plant needs of the district. The conference should include members of the school board, the superintendent of schools, the school principal, and the architect if one has been selected. It is important at this time to re-assess the results of surveys, studies, the educational plan and the educational specifications.

Annotation. Approval of Sites. See Sec. 5.4.

c. During this conference such factors as the school site, the school district's financial resources, and related problem areas are discussed and clarified. Through an analysis and evaluation of enrollments, curriculum offerings, and the present physical plant facilities, it is possible to further define the type, kind and extent of new construction needed.

d. Also involved in this analysis is a discussion of the importance of the architects, engineers, and their preliminary plan studies. The conference concludes with a general discussion of the problems and procedures in carrying through the preliminary planning, the involvement of citizen's groups, the need for consultants in fiscal matters, the need for further conferences, and similar procedures. No school board or administrator should proceed with a building program without first having this conference with the State Director of School Plant Planning.

22.0 SELECTING THE ARCHITECTURAL AND ENGINEERING SERVICES

22.1 Survey of the Field. Once a school district determines it is necessary to construct school building facilities to satisfy needs for the housing of the school population, it is necessary for the school board to seek the services of a competent and properly licensed firm of architects. The selection of an architect who can work effectively with the school board over a long period of time is important. The board should use extreme care in this selection as the services which the architect will perform are the key to a satisfactory building project. There are many well-qualified and competent architects available to any school board in Minnesota and the selection may be done in several ways.

a. **Questionnaires and Interviews.** A school administration may prepare a questionnaire for each architectural firm outlining the information upon which it desires to base a selection. This questionnaire may concern the experience, size of staff, consultants used and any other information which the school board considers pertinent. This request for information may be sent to a large number of architectural firms and from the results of such a questionnaire the school board may assemble a smaller list of firms, preferably not more than three, which it wishes to interview on a personal basis.

The interviewing of architects should be at a special meeting called for the specific purpose of interviewing architects. Ample time should be allowed for each architect to present his qualifications and discuss his background and experience thoroughly before the board. From such interviews it is usually possible for a board to determine which architect is best suited for the particular project at hand.

Annotation: Engineers. The board should determine the names of the consulting engineers (structural, mechanical, and electrical) retained by the architect. If the board has certain preferences as to the consulting engineers, these should be made known during the architect's interview.

b. **Visiting Schools and Firms.** In making a final determination, a school board should visit projects done by the architect under consideration and discuss the qualifications of each architect with the school board and school superintendent with whom the architect has had previous experience. It is also recommended the school board visit the architect's offices to determine the actual facilities with which the architect works.

Since the architect selected will have a large and important part in the success of the building project, this selection should be made with extreme care. The association between the architect and his school board client often lasts a number of years and this relationship should be harmonious in every possible way.

c. **Direct Selection.** In come cases a school board may have had previous experience with one or more firms of architects, or they may have accurate information concerning architectural firms. This may enable them to make a direct selection.

22.2 General Qualifications. Because the project to be undertaken may involve large expenditures and may extend over a considerable period of time, it is important that the selected architect possess the ability, imagination, integrity, and financial stability to insure the successful completion of his work. The services which the architect will perform are personal services; therefore a particular firm is usually selected because of the personnel involved. However, due to the continually increasing complexity of school building construction, it is important the architect have adequate personnel and resources available to insure his continued satisfactory performance. This should include the services of a properly qualified personnel in the fields of architecture and engineering.

22.3 Contract Negotiation. When a school board has selected the architect for the project, it is important the agreement between the two parties be formalized in a contract outlining precisely the obligations of both the architect and the school board. The Minnesota School Board Association and the Minnesota Society of Architects of the American Institute of Architects have jointly prepared a form of contractual agreement for architectural services. It is recommended this form be used whenever possible. The agreement sets out briefly and precisely the responsibilities of the architect and the obligations of the school board in almost any type of building project. It should adequately protect the interest of both parties of the contract.

ANNOTATION. It is recommended that the agreement include provision for MASTER PLANNING by the architect of future project expansion due to predicted population growth or potential district enlargement. See 282.1 b.

22.4 FEES. Most competent architects will agree to undertake any given project for approximately the same fee, although the services performed by all architects, since they are of a personal nature, cannot be exactly alike. For the same reason it cannot be expected that all architects would charge exactly the same fee for any particular project. A school board must not expect that an architect offering to do work for a lower fee than other firms will necessarily save the board money. The fee paid the architect is a comparatively small part of the overall cost of a building project and it is entirely possible an architect could save his client money by charging a higher fee and so enabling the architect to provide services of a higher quality, thus providing a design that might be more efficient and workable than one which could be procured for a lower fee from a different architect.

22.5 OUTLINE OF ARCHITECT'S SERVICE. An architect's services are normally divided into four separate phases consisting of the following:

(1) **Preliminary phase** covers all work necessary for the preliminary study of the site and the building program and preparation of the work necessary to prepare for a bond election.

(2) **Development phase** develops preliminary sketches to the point where they can be the basis for the final working drawings and specifications.

(3) **Construction document phase** consists of preparation of the actual working drawings and specifications, which will later become part of the contract documents for the construction and administration of the construction work.

(4) **Construction phase** includes services to be performed by the architect during the construction period of the contract.

The services of the architect during this period consist generally of overseeing the construction of the project—both by visits to the site and by the necessary coordinating work that is done in the architect's office. Much of the architect's work incidental to the construction is performed in his office without the knowledge of the owner and includes such services as preparation of contract documents, checking of a large number of full-size and large-scale shop drawings, checking and approval of contractor's statements, correlation of the work of the several contractors, preparation of complete color schedules, and general administration of the entire project. The actual site inspection is usually handled by periodical trips to the site by the architect or his representative.

In the case of large projects, the school board should consider retaining the services of a **resident inspector** to serve on a full-time basis as a supervisor of the work. Such a resident inspector is responsible to the architect for reports

on the progress of the work and for the coordination of the contractors, and for full-time inspection of materials and workmanship. The basis of employment of such an inspector is usually the subject of a special agreement between the owner and the architect and he is usually engaged by and is responsible to the architect but is paid by the owner. In some unusually large projects the resident inspector may be furnished as a part of the architect's contract if the architect's fee has been established accordingly.

23.0 PRELIMINARY PLANNING PHASE

23.1 SITE FACTORS. As the first part of the architect's work, he will require complete information as to the building site, including the accessibility of utilities, streets, easements, boundaries, topography and any other natural restrictions which will influence the design of the building. This should be furnished by the owner in the form of an accurate survey of the site prepared by a licensed surveyor which should indicate all the features of the site for the use of the architect. It will also be necessary for the owner to furnish the architect sub-soil tests which should be made by a testing laboratory with adequate facilities for such work although this information can normally be supplied at a latter time unless there is reason for doubt as to the suitability of the site for building purposes.

23.2 EDUCATIONAL SPECIFICATIONS. The architect should also be furnished, through conferences with the school board, with all pertinent information as to the curriculum, enrollment, special facilities which may be required and all other information as to the proposed use of the building to be designed. This material should be available at this time from investigations which the school administration will previously have made of these factors. This information is usually known as **Educational Specifications.**

ANNOTATION: It is suggested that the following elements be included in the written Educational Specifications, subject to local modifications:

1. The Project: Identification; background information.

2. The Program: Educational philosophy; scope and sequence of the program; local and state requirements; graduation requirements if grades 10–12 included.

3. Facility Implications: Manner in which courses are to be organized, scheduled and taught; planned use of flexible educational techniques, i.e., team teaching, interns, variable groupings, flexible scheduling, communications media, individual work areas.

4. School Plant (general considerations): General instructional spaces; special instructional spaces; administrative and auxiliary spaces; special facilities; storage; orientation and area relationships; traffic patterns; parking; utilities; provisions for visual and physical comfort; color, decoration and acoustical treatment; emergency shelters; and others.

5. School Plant (specific considerations): List of all rooms and spaces needed; description of activities; equipment needed; storage facilities needed; approximate floor areas of rooms and spaces. EXAMPLE: Some typical rooms and spaces

in a secondary school. Not all are applicable to every school. Grouping of subject areas into logical centers is suggested:

- Administration Center
  - Administration Area
  - Guidance and Counseling
  - Health
- Instructional Materials Center
  - Library
  - A-V Education
  - Materials Production
- Student Activity Center
  - Student Council Area
  - School Lunch Area
- Arts Center
  - *Arts and Crafts
  - Music Rooms
  - Multi-Use Auditorium
  - *Industrial Arts
- Language-Social Studies Center
  - English
  - #Foreign Language(s)
  - Social Studies
- Math-Science Center
  - Mathematics
  - Science
- *Agriculture Education
- *Business Education
- *Homemaking Education
- *Trade and Industrial Education
- Distributive Education
- Physical and Health Education
  - Gymnasium(s)
  - Locker Rooms
  - Health Classrooms
- Driver Education
- Special Education
- Site Development, including Athletic Fields

---

*Require laboratories or shops.

#May include a language laboratory.

23.3 Preliminary Schemes. Once this information (educational specifications) is assembled, the architect will be able to prepare preliminary sketches which will outline in plan form the proposed layout of the building and its facilities and the relation of these to the proposed site. The preparation of these preliminary sketches will usually involve one or more further meetings with the school board to discuss details.

23.4 Materials Selection. During this preliminary study, the architect will be considering proper materials for the various parts of the building, structural and mechanical systems which he thinks to be proper and suitable considering the nature of the project and the budget under which it must be built. He will normally at this time have consulted with the fire underwriter's inspection bureau as to probable insurance rates so as to provide a building which will be low in maintenance and operating costs.

23.5 Cost Estimates. During this preliminary stage, the architect will also expect to submit a preliminary cost estimate covering the construction cost of the proposed building in accordance with the sketches being considered. Because of the lack of detail at this period and the substantial variation of building costs due to outside reasons this estimate must necessarily be limited in its accuracy, but will normally be based on a comparison of similar projects being built under similar conditions on which costs are already known. It is not possible for an architect to guarantee the accuracy of cost estimates made under these conditions but an experienced architect can usually estimate within a relatively close margin so that the school board may determine whether the project is economically feasible at this stage.

23.6 Approval of Preliminary Sketches. When the architect and the school board have consulted sufficiently and have examined in detail the proposed preliminary drawings, it is necessary that the board by official action approve the preliminary drawings so that they may be used in the preparation of material for a bond election to finance the construction.

Before the preliminary drawings are presented to a school district for an election on a bond issue to finance the project, the preliminary plans should be reviewed with the State Director of School Plant Planning and tentative approval should be received from his office on this scheme before it is presented to the school district. An architect will then usually expect to provide the school board with the information it needs in presenting this program to the voters for a bond election.

24.0 FINANCING THE BUILDING PROGRAM

24.1 Authority to Build. When the school board has studied the Preliminary Phase of the building needs with the architect, it can reasonably ascertain the amount of money needed to provide the needed additional facilities for the school district. The school board must then seek the authority to bond the district if sufficient funds are not available. The authority to issue bonds to finance a building program must come from the voters of the school district. The school board may call a special election for this purpose, or the question may be voted at the time of the regular school election. A simple majority of those voting at the election is the needed requirement for passage.

Annotations:

1. See Minnesota Statutes Chapter 475 for laws relating to issue of bonds by school districts. Note: Check the most recent publication of Minnesota Statutes and Session Laws for amendments to statutes referred to.

2. Limitations on indebtedness school districts may occur are stated in M.S.A. 475.53 Subd. 4: (as amended Laws of 1965 Chapter 875 Section 11.)

> "Except as otherwise provided in sections 475.51 to 475.75, no school district other than those covered by subd. 5, shall be subject to a net debt in excess of ten percent of the correct full and true value of all taxable property therein as defined in this subdivision 4.
>
> "Correct full and true value" as used in this subdivision means the correct full and true value of the taxable property of a school district as most recently determined by the equalization aid review committee prior to the incurring of debt limited hereby in accordance with section 124.21, subdivision 4. The commissioner of taxation shall certify this value upon request of a school district.

3. Refer to Minnesota Statutes Chapter 275 for laws relating to "Taxes, Levies, Extension." M.S.A. 275.12 relates to "tax levies, schools; limits."

4. Under M.S.A. Section 124.43, as amended Laws of 1965, Chapter 875 Section 6. (Maximum Effort School Aid Law):

> "Subdivision 1. To the extent moneys are from time to time available hereunder, the committee (school loan committee) is authorized to effect capital loans to school

Section

districts but the net debt of each district at the time of receiving the initial proceeds from the loan must exceed 98 percent of its debt limit as prescribed by Minnesota Statutes, Chapter 475, or be within $20,000 of such limit. Proceeds of such loans shall be used only for sites for schoolhouses and for acquiring, bettering, furnishing, or equipping schoolhouses. Applications with the accompanying data specified in subdivision 2 shall be filed between October 1 of any year and June 1 next following.

This subdivision shall not apply to capital loans to restore and replace buildings, sites, equipment and furnishings destroyed or damaged by tornadoes or flood, when authorized by a special or local or other separate law, but this specifically shall supersede subdivisions 1 and 2 of Laws of 1965, Chapter 470, insofar as such subdivisions waive the requirements of this subdivision as to any other capital loans."

5. School districts should consider inserting a clause in the bond contract to the effect that a portion of the bonds may be "called" or retired in advance of maturity date. This should be done particularly when interest rates are high, with due consideration to the comparative interest rates with and without the "call" feature.

24.2 Fiscal Service

a. Feasibility of a building program is directly related to the financial capabilities of the district. In order to correlate the fiscal program with that of the building program, the board should engage a bond consultant or fiscal agent as they are sometimes called, as early in the program as possible. The bond consultant will advise the board with respect to the building program fiscal policies to be presented to the voters. With the board he will plan for both the present and future potentials of the district.

b. An optional feature of a bond consultant's service is his assistance with presenting the facts pertinent to the bond election. He will prepare press releases, a brochure and otherwise advise as to procedures. The bond consultant will make estimates of the tax cost of the bond issue. These should be as realistic as possible. The voters will not soon forget a mill levy considerably higher than the estimates of pre-election publicity.

24.3 Legal Service. Before bonds can be issued all of the proceedings of calling and holding an election, resolutions providing for sale of bonds, etc., must be examined by recognized bond approving attorneys. If these proceedings are legally sufficient these attorneys will prepare a written opinion to that effect at the time the bonds are delivered to the purchaser. Without this opinion the bonds cannot be sold. Each step necessary to issuing bonds should be examined and approved by bond counsel as it is taken. This can be arranged for the board by its local attorney or bond consultant. The services of the latter are non-legal; anything he has to do with legal proceedings are clerical in nature. If the board wished to fix responsibility for the legality of the proceedings at a point less removed than the approving attorneys, it should retain local counsel. Functions of the bond consultant and the attorneys, local or bond counsel, should not be confused. Each is an expert in his own field but not necessarily in both.

Section

24.4 Public Relations. Proper contact with the voters of the school district is most important before they are asked to vote on the question of providing monies for school building purposes. The school board must take careful pains to see that all the voters of the school district have at their disposal all factual information as it relates to the question to be voted upon. This information should contain projected enrollments, educational philosophy of the school district, cost of the project, and what may be accomplished if the voters approve the project. Disbursements of this material can be done in a number of ways.

(1) The school board may want the service of a citizens committee to work with the school administration, school board, bond consultant, and the architect in a program of disbursing factual information to the community. A citizens committee can be formed in a number of ways. It can be appointed by the school board, or various organizations within the community can be asked to designate persons to serve in this capacity. It is most important that membership of such a committee be representative of all walks of life, and of all levels of economic ability.

(2) The local press should be contacted and briefed as to the proposed building program. Factual articles should be prepared for publication in the official and other newspapers of the school district. The school administration, school board, bond consultant, architect, and the citizens committee should prepare a factual brochure for distribution purposes within the school district. All questions must have the benefit of factual answers to avoid misinformation or malicious rumors.

(3) The same group of people should make themselves available to speak to various groups and organizations on the bond election and the projected proposal for additional facilities. It is good practice to establish a speaker's bureau from within the cooperating groups and make the fact known that speakers are available to answer questions relating to the building program.

24.5 Bond Issue Election. When the school board has determined the election date it shall direct the clerk to advertise the election in the official newspaper of the district. The clerk shall post the election notices in the normal posting areas. The above actions must take place at least 10 days before the date of the election. The election notices should be prepared with the approval of bond attorneys and the notice must clearly state the question to be voted upon. If the question is not clearly stated the vote may then be subject to court action which could rule the election void. After the polls have closed and the vote counted the school board will canvas the ballot. If the majority of those voting have cost their ballots favorably to the stated question the school board has been given the authority to proceed.

If the election fails the question may be re-submitted for vote at any time the school board designated, providing the posting of the election notices and the advertising in the official newspaper meets the 10-day requirement of Minnesota Law.

Annotation. Under M.S.A. 475.59 ". . . In any school district, the school board or board of education may, according to its judgement and discretion, submit as a single

Section

ballot question or as two or more separate questions in the notice of election and ballots the proposition of their issuance for any one or more of the following, stated conjunctively or in the alternative: acquisition or enlargement of sites, acquisition, betterment, erection, furnishing, equipping of one or more new schoolhouses; remodeling, repairing, improving, adding to, betterment, furnishing, equipping of one or more existing schoolhouses."

24.6 Sale of School Bonds. The school board will confer with the bond consultant and set a date and time for the sale of the bonds. If the district is eligible for a rating by a nationally recognized rating firm and if the bond consultant thinks it to the advantage of the district to have a rating he will submit the necessary detailed information with the request that the bonds be rated. The bond consultant will then advertise the sale of the bonds in the bond market areas of the nation. The bond consultant will prepare a prospectus containing all the factual information relating to the financial ability of the district. The prospectus will be made available to all persons or firms who might be potential buyers of the school bonds. The bond buyers will submit sealed bids for the purchase of the bonds which will be opened on the stated day and time as previously determined by the school board. The opening of the sealed bids should take place under the supervision of the bond consultant. Any question as to the legality of the bids should be decided by the attorney.

The school board may accept the lowest bid or reject all bids. Unless there are extenuating circumstances, action should be taken upon the bids at the time they are opened. By custom of the bond trade, bids are submitted for immediate acceptance or refusal. After a school board reject the bids, they may readvertise the bonds for sale.

Annotations:

1. **Sale of Bonds, Advertisement.** All bonds of the district, except as the requirement is waived in the law, must be sold at public sale after notice given at least ten days in advance by publication in a legal newspaper having general circulation in the school district and ten days in advance by publication in a daily or weekly periodical published in a Minnesota city of the first class, which circulates throughout the state and furnishes financial news as a part of its services. (M.S.A. 475.60 Subdivision 1.)

2. **Tax Levy and Debt Redemption Fund.** Minnesota Statutes provide that when a bond issue is sold the school board, prior to the delivery of the bonds, must levy a direct general tax upon the property of the district for the payment of the principal and interest on such bonds when due. (See M.S. Sec. 475.61.)

The revenue from such a tax must be separately accounted for in a **Debt Redemption Fund.** (See Manual of Instructions for Uniform Financial Accounting for Minnesota School Districts, page VI–79.)

3. **Building Construction Fund.** Proceeds from the sale of bonds should be placed in the Building Construction Fund as directed in the Manual of Instructions for Uniform Financial Accounting for Minnesota School Districts, page VI–76.

Section

4. **Investment of Surplus Funds.** If the funds in the Building Construction Fund (or the Debt Redemption Fund) are not currently needed, the school board may authorize the investment of such funds in certain types of securities specified by law. (See M.S. Sec. 475.66.) Any earnings from such investments become a part of the fund from which taken. For the accounting procedure in making such investments, see in Manual of Instructions for Uniform Financial Accounting, page XI–21.

25.0 DEVELOPMENT OF FINAL PLANS AND SPECIFICATIONS

25.1 General

a. The preparation of final plans and specifications by the architects and engineers will require from two to eight months depending upon the size and extent of the building program.

b. When the school board has been authorized to build, the school board, should then, through a resolution, instruct the superintendent to notify the architect in writing that he should now proceed to prepare the final preliminary plans from which the specifications and working drawings for the project will be detailed. Many consultations will take place between the architects and engineers, and the school board and administration in finalizing plans, selecting materials and formalizing the design of the building. The school board should always take into account the limitations of the budget and the equally important factor of designing a frugal, efficient, effective, and functional school building—a building that can be maintained over the period of its life span for the lowest maintenance cost. When the final preliminaries have been accepted by the school board, a review of the plans should then be made in joint conference with the Director of School Plant Planning involving the architect, superintendent, principals, and members of the school board.

Annotation: As the architect proceeds to develop the various areas of the building, 4 copies each of enlarged prints showing equipment and cabinet layouts should be submitted to the state Director for review by the respective state supervisors for such programs as art, A-V education, agriculture, business education, home economics, industrial arts, library, science, and school lunch kitchens.

c. When the working drawings and specifications have been completed, the school board is required to examine, evaluate and to accept by resolution the plans of the architect for construction. It is extremely important at this juncture that the school board, the administration and the teaching staff fully realize and understand the plans. For this reason the architect should fully describe and explain the plans in detail. Any changes that are made in the plans after the acceptance by the school board will usually be at additional cost.

d. The insurance protection program of the project should be thoroughly explained by the architect and well understood by the school board and the superintendent. It would seem highly desirable that the school board attorney should be present in reviewing the insurance program and other details contained within the specifications.

Section

e. Minnesota Statutes require all working drawings and specifications to be approved by the State Department of Education before contracts are let. The State Department of Education's approval includes the approval of the State Fire Marshal. The Statutes require the mechanical plans and specifications to be approved by the State Department of Health. Any changes required by the State Director of School Plant Planning or of any of the state agencies should be made before the bids are called and contracts let. If not, these changes may involve extra costs to the school board.

Annotation. See Section 6.4 this manual, "State Board of Electricity." The National Electric Code governs all electrical installations in new buildings or major remodeling or repair and is rigidly enforced by inspectors of the State Board of Electricity. For an established fee, the State Board of Electricity will review electrical plans.

25.2 Completion Dates. If the school board is sufficiently pressed for additional housing, it may be advisable to require contractors to complete the construction by a certain date. If so, a specified completion date can be set forth in the specifications incorporated with an appropriate penalty clause. If the board desires to know whether or not a firm completion date will involve extra cost to the board, this may be included as an extra. Under any circumstances, it is advisable to include in the specifications or contracts a completion schedule whether there be a penalty clause or not.

25.3 Advertising for Bids. Statutes require the advertising for bids at least two weeks prior to the opening of bids. Good procedure, however, would suggest that bids be advertised for a period of at least three or possibly up to six weeks in order to give all interested contractors an opportunity to bid. The bidding procedure of contractors involves securing material prices and bids from many sub-contractors in order to make the most accurate bid. This takes time and it is to the advantage of the school board to provide an adequate time element. The determinations of bidding and the letting of bids should include the recommendations of the architect and the school board's attorney.

Annotation. For statutory requirements for advertising for bids and awarding contracts, see M.S.A. 123.37. No contract for the construction or repair of school buildings, or for the purchase of furniture or equipment the estimated cost or value of which shall exceed $2000 shall be made by the school board without advertising for bids in accordance with law.

25.4 Accepting the Lowest Responsible Bidder. Minnesota Statutes require a school board to award a contract to the lowest responsible bidder in each instance. (If no satisfactory bid is received the board may reject all bids and readvertise.) The school board is protected through the performance bond as to the financial responsibility of the contractors involved in each contract. The integrity of the contractor and the type of skills and workmanship involved in his crew are so important that the architect and school board should give due attention to the flexibility of the law through the proper interpretation of the word "responsible." A responsible bidder has been defined by several Attorney General's opinions, one of which is included in the Annotations following this section.

Section

It is equally important at this time to give due consideration to the use of a full-time Resident Inspector to represent the interests of the school board during the construction phase of the project. The supervision provided by a full-time supervisor along with the supervision provided by the architect constitute the only assurance the school board will have that the building will be constructed and completed in conformity with the plans and specifications prepared by the architect. The dependability and the reliance of this supervision will, however, be contingent upon the intregrity, training and experience of the architect and the resident inspector selected for the task.

Annotations:

1. Contractor's Performance Bond. See M.S. 574.26-574.30.

2. Inference as to the meaning of "lowest responsible bidder" may be made from the following excerpts from an Opinion of the Attorney General, "Lowest Responsible Bidder—Meaning of," dated March 23, 1956.

"The quotations from decisions of the court mentioned below are expressions of the court on the meaning of the words 'lowest responsible bidder' as they are used in the statutes of other states:

> "Lowest responsible bidder' refers not to pecuniary ability only, but also to judgement and skills.
> "It means one who complies with all the requirements of the statutes, specifications, etc., not merely one whose bid is less than his competitors.
>
> "It means one who is responsible and offers the lowest price.
>
> "Selection of lowest responsible bidders requires that not only the pecuniary ability but also the judgement, skill, capacity and integrity of bidders is to be considered. This inquiry is not to be limited to financial responsibility, but should also include fitness and ability of the bidder to do and perform the particular work. Consideration should be given to his ability, capacity, experience, efficiency and reputation. Among the bidders, the board should judge which is most capable of doing the work in a satisfactory manner.
>
> "For more detail and for the citation of the cases where such language is found, see 25W. & P., Perm. Ed. 714.716.
> "In the pocket part a case is cited to the effect that no mandatory obligation is imposed on the board to consider the lowest dollar and cents bid as being the lowest responsible bid."

26.0 CONSTRUCTION OF THE BUILDING

26.1 Inspection During Construction Period. General inspection of construction is a responsibility of the architect and payment for this service is included in his fee. This inspection is periodic and sufficient to check the progress of the work and general compliance with the contract requirements. It does not include a full-time resident inspector.

On larger projects a full-time Inspector is usually considered necessary. The decision as to when the size of the project warrants his employment is a matter of judgement between the architect and the board. This decision as well as terms of the payment of the full-time resident inspector should be agreed upon at the time the architect is employed. The full-time inspector is an employee of the board responsible to the board through the architect.

The supervision provided by the full-time resident inspector plus the supervision provided by the architect are the only assurance that the board has that the project will be constructed and completed in conformity with the plans and specifications prepared by the architect.

Construction time will vary from 6 months to 2 years depending on the size of the project.

26.2 Changes in Plans. Any changes in plans after construction has started usually involves extra expense for the board. If the architect is allowed ample time for the preparation of the plans and if the board is thoroughly familiarized with the plans, such changes should be reduced to a minimum. All changes in plans should be negotiated through the architect and he should protect the owner from excessive costs due to such changes.

Any dispute arising from major disagreements should be submitted to Arbitration as provided by law.

26.3 Inspection by the Board. The school board should make periodic inspections during construction in order to keep itself informed of the progress of the work.

Final Inspection by the board is made just prior to acceptance of the building. The building at the time of this final inspection should be virtually completed, although there may still be a punch list of minor details that need attention.

26.4 Final Settlement. When the board, subsequent to its final inspection, is satisfied with the virtual completion of the building, and when the architect and the superintendent so recommend it, it is the responsibility of the board by Resolution to formally accept the building.

Responsibility for Insurance protection of the new building should be transferred from the contractor to the schoolboard at the time of such acceptance.

27.0 PUTTING THE BUILDING INTO SERVICE

Manuals providing operating instructions and sources of repair parts for mechanical and electrical installations and other maintenance information should be bound and supplied in triplicate to the school administration. Assembling this information and material from various manufacturers and suppliers and putting it into presentable form should be the responsibility of the architect and/or mechanical engineer. See Sections 110.5 and 239.

The Skill and Training of operating personnel is a decided factor in maintaining satisfactory operation and continued good appearance of a new school plant. Hence, careful selection of competent personnel must be stressed.

A Short Course for the training of school maintenance men has been introduced by Dunwoody Institute of Minneapolis. School boards should avail themselves of the opportunity not only for providing training for new men, but refresher courses for experienced men.

Annotation: There is need for a mechanical-electrical equipment maintenance man in each new school building as well as the regular custodial service men. See Section 110, "Facilities for Mechanical-Electrical Equipment Maintenance and School Plant Custodial Services."

28.0 CONTRACT AGREEMENT. Copies of the Contract Agreement prepared and approved by the Minnesota School Board Association and the Minnesota Society of Architects, A.I.A., may be obtained from the Minnesota Society of Architects, 3416 University Avenue S.E., Minneapolis 14, Minnesota.

29.0 CERTIFICATE OF COMPLETION OF SCHOOL BUILDING CONSTRUCTION. See Section 5.54 for statement of this requirement.

Annotation: **Inspection of School Building within Guarantee Period.** It is recommended that within the period of guarantees furnished by contractors, vendors, or manufacturers covering building and equipment—usually 12 months after official acceptance of the building by the school board, the architect and engineer(s) with whom the board has a contractual agreement shall make two inspections of the building and operating equipment. The first such inspection is to be made approximately six months from the date of acceptance of the building by the board, and the second inspection before the expiration dates of the respective guarantees.

After each inspection, the architect and engineers should report their findings in triplicate to the local school board. The school board should send a copy of each report to the respective bonding company(s) bonding any contractor and to the School Plant Planning Section, State Department of Education.

Note: To secure the inspection service stated above, the school board should include a statement to this effect in its contractual agreement with the architect and engineer(s).

30-39 Reserved for future use.

PART II

THE PLANNING AND DEVELOPING OF SCHOOL PLANT FACILITIES

SECTIONS 40-49. THE SCHOOL SITE

Section

40.0 SELECTING SITES, GENERAL ASPECTS

40.1 Scope. Site selection is an important part of long-term school plant planning. Site acquisition should not follow population increase but anticipate it. The site should be purchased before the need becomes critical and when sufficient and reasonably priced acreage is still available.

40.2 Cooperative Aspects. In the earliest planning stages, the selection of a site requires the cooperative effort of the board, school staff, planning committee, architect, site planning consultant, and school attorney. Since the educational program is an active interest of the community, lay members on a site selection team may be valuable.

40.3 Site Evaluation. Probably no site will meet every criteria for selection and it is advisable to evaluate several or all potential sites. The merit of a checklist, and many are available, is mostly for comparison of all the conditions to be evaluated.

40.4 Minnesota Statutes Relating to Sites. These include:

M.S. 123.36 Subd. 1. Authority of the board to locate and acquire sites when funds are available.

M.S. 123.63 Eminent domain.

M.S. 121.15 Authority for state board of education rules.

40.5 State Board of Education Regulations and Department Directives

Regulations: Edu 422 Sites. "In the selection of a school site the school board shall be guided by the criteria for school site selection stated in the Guide for Educational Planning of Public School Buildings and Sites, Article V, Section 28; and during the consideration of a site, before a contract for its purchase is made, the school board or its representative(s) shall confer with the Commissioner, in a manner set forth by him, on the educational adequacy of the site and its suitability for sound school construction and maintenance."

Directives: (Relating to Edu 422 Sites—State Department of Education)

"1. Conferring with the Commissioner of Education will consist of addressing a letter to the Director of School Plant Planning in which is stated:

a. The size and location of the proposed site.

b. The type of school building planned for the site—elementary, junior high, senior high or combination.

c. The suitability of the site when checked against criteria presented in the building Guide.

d. Realistic evaluation of site from a local point of view, summarizing advantages, disadvantages, and problems.

Section

Note: "c" and "d" may be combined. A professional evaluation is recommended.

e. A request by the school board for the approval or disapproval of the site, as the case may be.

2. In every case the receipt of a notice of approval of the proposed site is necessary before a school site is to be purchased by the school board. An 'on-the-spot' evaluation may or may not be necessary before notice of approval is given."

40.6 Information of Value in Site Selection. Construct a composite map or aerial photo showing the following basic data:

—school boundaries (school service areas)
—government boundaries
—physical boundaries (topography)
—streets and highways
—zoning (from land use maps)
—population.

Then supplement with such data as the following:

—population projections from data of telephone, power and water companies
—building permits, land ownership and information from builders
—pre-school pupil spot maps
—dwelling unit maps
—soil maps; flood control maps; utility service extension plans.

41.0 CRITERIA FOR SITE SELECTION. Conditions vary widely from community to community with respect to educational programs, financial resources, public recreation programs and other significant factors to be used in judging school sites. There are, however, certain commonly accepted criteria which are reasonably applicable.

41.1 General. The site should be selected considering:

a. The nature of the district's total educational program.

b. The type of school building required: elementary (k, 1-6); junior secondary (7, 8, 9); senior secondary (10, 11, 12); combination (K, 1–12); or other.

c. The ultimate number of prospective pupils.

d. The proposed utilization of the site for community programs.

e. The policy of the school district concerning transportation of children.

f. The provision of a pleasant, safe environment, possibly a school-park complex in urban areas.

g. Protection of investment in the school building.

41.2 Community. The site should have proper relationship to existing and proposed community facilities. In urban areas, it will be necessary to work with planning commissions and other boards or agencies to develop a cooperative or compatible policy.

41.3 Accessibility. Schools should be located near the center of population in walking areas. Reasonable walking distances for pupils walking to school are: elementary schools (k, 1-6), ¾ mile; junior secondary schools, 1½ miles; senior secondary schools, 2 miles. The school site should be conveniently accessible to those who are transported. Bus travel time should be carefully analyzed.

41.4 Safeguards from Hazards. The site should be located so as to safeguard the children from hazards and undesirable environment, such as:

a. Arterial highways, heavily traveled streets, traffic, and congestion.

b. Noise, smoke, odors—from railroads, airports, and odeferous plants or industries.

c. Natural barriers limiting accessibility and expansibility, such as rivers, lakes, swamps, and protruding ridges.

d. High voltage transmission lines, booster or reduction stations, high pressure gas lines, and transformer stations.

e. Taverns, fire stations, airports, bulk storage plants for inflammable liquids, and property zoned as industrial.

41.5 Public Utilities. The site should be located so that water, sewer (or sewage disposal), electricity, gas, and other utilities can be provided at reasonable cost. Local government water and sewer extension policies and codes should be checked.

41.51 Water and Sewer Systems

a. Before purchasing any school site, a school board should consult with the State Department of Health regarding both water supply and sewage disposal.

b. No water supply system or system of sewage disposal may be installed, altered, or extended until complete plans and specifications for the same have been submitted to and approved by the State Board of Health.

41.52 Electric Power, Light, Gas, Telephone. Before purchase of a site, utility companies should be consulted and assurance obtained that gas, light, power, and telephone service can be installed without excessive cost for construction of mains and transmission lines. Lack of such facilities or excessive cost to obtain them may be a deciding factor in the selection of a site. See Sections 262.2–262.22 for statement relating to electric power lines.

41.6 Suitability for Construction. The site should be selected with consideration for the feasibility of constructing a building on the site from an architectural and site-utilization standpoint. The services of an architect and planning consultant are necessary to judge a site on this criterion.

41.61 Topography. The site should have an elevation and contour which will insure good drainage and a type of subsoil which provides a good base for building footings and foundations.

41.62 Cost of Improvements. Among the conditions to be determined in advance and considered along with the purchase price are the following:

a. The need for razing or moving present structures on the site.

b. The need for extensive hauling of dirt due to a shortage of fill dirt and topsoil on the site.

c. The presence of rock or other conditions affecting the cost of necessary excavation or ditches.

d. The presence of quicksand, unsatisfactory fill, or other undesirable subsoil conditions requiring special footings or pilings to support the building.

e. The need for removal of large boulders or trees; the need for filling or capping of old wells, clay holes, or pits.

f. The need for drainage of an unduly expensive nature.

g. The need for constructing and maintaining long access drives and special installations, due to distance from service facilities.

h. Normal ground water table.

41.63 Test Borings. Such adverse conditions as listed in 41.62 can usually be overcome by modern construction methods, but they should be accepted only when the costs of such improvements are reasonable.

Before the land is purchased, test borings should be made to accurately determine subsoil conditions and the results should be analyzed and interpreted for the board by a competent engineer, architect or soil specialist.

42.0 SIZE OF SITES

42.1 General. The most important single question that can be raised about a proposed site is whether it provides sufficient and appropriate space for all of the in-school, evening, and summer activities of pupils and adults of the area to be served, as well as for the building itself and the related service activities, both for the present and the forseeable future.

42.2 Trial Analysis. Before the size of site for a given school can be determined, there must be a local decision with respect to each type of space to be considered. The only satisfactory way to determine the acreage needed is to make trial layouts for each site under consideration. The services of a site planning consultant and an architect can be very helpful for this purpose. For example, in a trial analysis of the area required for the site of a secondary school, the following items might be checked.

42.21 Areas to be considered	**Estimated Acreage**
(1) For the school building................	________
(2) Reserve for expansion of building........	________
(3) Setbacks from streets, sidewalks, approaches, and driveways.............	________
(4) Bus loading area and/or turnarounds.....	________

Section

(5) Parking areas, access, and buffer........ ________

(6) Bicycle entrances and storage racks, with proper buffer areas............... ________

(7) Landscaping and buffer areas at the side and back of the site............... ________

(8) Paved game areas including space for outdoor basketball and tennis courts*.... ________

(9) Field game areas for physical education and recreation*..................... ________

(10) Areas for interscholastic athletics*....... ________
  (a) Football Field
  (b) Practice field
  (c) Track
  (d) Baseball and softball diamond
  (e) Hockey rink

(11) Possible athletic stadium with parking areas, access and buffer................ ________

(12) Outdoor educational areas for nature study, biology, art, etc................. ________

(13) Driver instruction areas (auto).......... ________

(14) Outdoor area adjacent to shops.......... ________

(15) Sewage disposal area, if required......... ________

(16) Reserve area for future use.............. ________

(17) Other (not listed above)................ ________

Note: A similar trial analysis may be made for any site to be considered for an elementary school.

---

*For suggested areas, see Sections 87.92–87.95.

42.3 Desirable Acreage. Based on the experiences of Minnesota school boards who have planned new construction in recent years, and in line with national trends, it is recommended, where acreage is available and costs reasonable, that school sites of the following approximate sizes be provided:

Elementary Schools	10–15 acres
Secondary Schools	
Junior high schools	25–35 acres
Senior high schools	40–50 acres
Junior-Senior high schools	40–50 acres
Combination schools (k, 1-12)	35–40 acres
Campus (Group: elementary and junior high; or junior and senior high schools	40–85 acres
Area Vocational Schools	20–40 acres

Note: If sewage treatment plants and retention ponds are required, acreage would have to be increased.

42.4 Urban Areas. In city and suburban areas in the process of development, long range plans should result in the early locating and purchasing of sites of adequate size for future schools. In build-up districts requiring new schools for expanded enrollments and programs, it may be necessary to accept sites smaller than desirable. One remedial measure would be to locate schools adjacent to parks or recreational facilities. On very restricted sites, multi-storied buildings may be necessary and all sources of playground space located and developed, even to the point of developing space under buildings.

42.5 Reserve Site Area. For modern schools, a portion of the site should be set aside to meet unknown needs that are bound to arise in the future. Many schools constructed in the past have become obsolete because they lacked sufficient site to warrant economical rehabilitation. Buying an adequate site is insurance against such educational obsolescence.

43.0 SITE DEVELOPMENT

43.1 Procedures. The same general planning procedures as for planning the building are appropriate for outdoor facilities. The process of educational planning, writing educational specifications, and architectural designing is generally as applicable to sites as to building.

43.2 Architectural and Engineering Planning Steps. These include:

a. Developing a master site plan coordinating in proper scale the location and orientation of the building; location of walks, drives, parking, and service areas; design and layout of physical education and other outdoor facilities.

b. Development of the master site plan into workable construction drawings with consideration given to grading, drainage, water supply, road and walk construction, parking area construction, creation of outdoor instructional and recreational facilities, lawns, gardens, and other desired facilities.

Note: School buildings must be set high enough on sites to avoid any problem of water entering the building, especially the basement areas. There should be a fast drop of soil (12–15 inches) extending 12 to 15 feet from the building.

c. Development of site planning plan with materials chosen to provide a proper scale of surroundings in relation to the building, beautification of lawn and boundaries, screening of park areas and service features, shade, and integration of recreation activity areas.

d. Drafting of specifications and estimates by landscape architect for each construction item.

43.3 Utilities. Utilities and budgets for utilities should be planned to adequately take care of not only the building but also the total site development and anticipated expansion. See Sec. 41.5–41.52.

43.4 Site Development for Economy

43.41 Economy of Construction. Costs for excavations and foundation walls can be reduced by fitting the building to the contours of the land. Extra expense for special footings and special drainage can be eliminated by placing the building on high ground and where subsoil conditions are known to be favorable. Proper placement of the building will reduce the length of utility and drainage lines, drives, walks, and thus reduce costs.

43.42 Economy of Operation and Maintenance. On the operation and maintenance side, good planning can reduce the steepness of banks that might be subject to erosion;

Section

divert water that might affect the foundation of the building or damage drives and parking lots; and reduce the amount of paving and sidewalk that must be kept in good repair and free of snow. For safety in grass mowing, slopes should not be excessive.

NOTE: 3 or 4 to 1 ratio perferred maximum.

43.5 SITE DEVELOPMENT FOR CIRCULATION AND TRAFFIC CONTROL

43.51 Scope. The school site should be easily and safely accessible from roads, streets, sidewalks, both for pupils walking to school and for those transported to school. There should be a limited number of points of entry to the school site in order to facilitate traffic control. These should be adequately separated.

For CONVENIENCE AND SAFETY, access for pedestrians from the street curbs to the building should have proper consideration; then access for those arriving by school bus, public conveyance, and by private cars; and finally access for delivery of materials and supplies to service areas and for garbage and refuse removal. Experience has shown that the access serving the largest number of persons should be given first consideration.

43.52 Walks. Walks should be direct, convenient and natural to encourage people to stay on them. They should connect the building with streets or highways, bus loading zone, parking areas, and auxiliary school facilities. Limiting points of access is desirable for control of traffic.

43.521 Width of Walks. Walks should be in lanes of at least 22″ (24″ desirable) with a minimum of 3 lanes or 66″ (72″ desirable).

Walks should be far enough from buildings to permit ample space for shrubbery, should be crowned or sloped high enough for proper drainage, and illuminated for night use. Wide paved areas at entrances will help keep the building clean by catching much dirt from shoes and rubbers before it gets inside; and a good slope will make this area easier to keep clean.

43.53 Driveways. In locating vehicular circulation on the school site, safety is a primary consideration. Secondary considerations are economy, convenience and directness. Driveways should be:

a. One way with clear views. Two lanes should be provided to main loading entrance and parking areas;

b. Hard surfaced, properly drained and illuminated for night use;

c. Planned to provide access and control traffic to loading areas, parking areas, and building service entrances. Wherever practical, driveways for buses should be separate from other driveways;

d. Located so as not to connect to a heavily traveled highway if a lightly traveled street is accessible. Points of access to the site should be limited. Many exits and entrances to state and county highways are governed by access regulations. The local resident engineer should be consulted.

Section

43.54 Parking Cars.

43.541 Needs To Be Met

a. STAFF. Teachers, pupils and other school employees who drive regularly will appreciate a well-drained shady area with a blacktop surface. A space sufficient for parking each car plus aisle space should be allowed.

b. TRANSIENT PARKING. Parents, school visitors and salesmen will appreciate safety and convenience. Signs indicating visitor or transient parking will help as will signs at the parking lot indicating the direction of the office.

c. SPECTATOR groups attending school or public activities require a large parking space for afternoon and evening activities. This area should be permanently surfaced and used as a play area during the school day. Multiple use courts may be constructed as part of this area provided construction features are suitable for car parking.

43.542 Quantity. Parking can be provided at the rate of about 125 cars per acre. The following quantities are suggested as reasonable:

a. For staff and incidental school time parking: 2 spaces per teaching station.

b. For pupils: A survey should be conducted for pupil parking needs at the secondary level and space provided as necessary.

c. For spectators:

(1) Rural areas; 1 space per 3 seats for spectators

(2) Urban areas: 1 space for each 6–8 seats, or to suit local conditions.

43.543 Arrangement.

a. Car parking should be so arranged as to minimize backing. Parking areas should be hard surfaced, well drained and illuminated for night use. Control signs are necessary.

b. Car parking should not be located on streets with traffic, on pedestrian lanes, driveways or loading areas; should be away from playgrounds, but near spectator areas when practical.

43.55 Bus Loading. The bus loading zone should be designed to accommodate all buses anticipated at one time. This should be based on:

a. The transportation survey: as to bus schedules, partial unloading or transfer of pupils, provision for handicapped children, and parking.

b. Number of pupils transported, based on the average number of pupils per bus or legal capacity of the bus.

c. Future growth or changes in the transportation pattern.

43.56 Bus Parking. The bus parking area should be designed in connection with the bus loading zone, independent of driveways, and so that backing is unnecessary. It should be permanently surfaced and well drained, with designated spaces and control signs.

NOTE: Some site planners prefer the bus parking area off-site.

Section

43.57 Bicycle Racks. Bicycle racks near the building are desirable for some schools. A survey to determine the need should indicate the rack space necessary.

43.6 SITE DEVELOPMENT TO IMPLEMENT PHYSICAL EDUCATION AND RECREATION PROGRAMS

43.61 Areas and Activities. For recommended activities and official dimensions of spaces, see sections on Health, Physical Education, and Recreation: Section 56—Elementary Schools and Section 87—Secondary Schools.

43.62 Interscholastic Athletic Program. Programs of interscholastic athletics to be provided by each school introduce special problems of site development. Among the major items to be considered for outdoor sports such as football, baseball, and track and field events are: official space requirements; space for spectator parking and circulation; spectator seating; sale and collection of tickets; possible sale of refreshments; flood lighting for night games; public address systems; team rooms; special space for coaches and officials, first aid, and equipment storage; and toilets for participants and spectators. Some of these spaces may be provided in the main building; others, in large cities with several secondary schools, may be provided in a special structure or stadium.

For space requirements for secondary school interscholastic games and events, see Sections 87.92–87.95, Health, Physical Education, and Recreation. In planning the utilization of site space, the interscholastic athletic program should not take precedence over health, physical education and recreation facilities for all.

43.63 Multiple Use of Areas. When any site is intended to provide for various combinations of grade levels, the separate requirements must be added together. However, certain play fields or areas may have multiple use or may overlap. The areas laid out for football, soccer, and field hockey in the fall may be the baseball fields, or softball fields, or archery ranges in the spring. The diamond portion of the baseball field or portions of the running track should not overlap any other field. In small schools, one field may be used for a variety of field games and scheduled so as to serve different groups at different periods. For seasonal games and sports it is necessary to provide removable goals and bases, and guard against other undesirable obstructions in the field area. Overuse of duplicate facilities will make grass maintenance difficult.

Section

Frequently, one permanently surfaced area can serve as an outdoor playground in muddy weather, as a space for outdoor basketball, tennis, and volleyball, and as an overflow parking space for special occasions.

43.64 Other Outdoor Activities.

a. Minnesota is well adapted to the development of winter sports such as skating, skiing, tobogganing. Consideration should be given to their inclusion in the physical education and recreation program.

b. The proposed site may offer opportunity for instruction in biology, science, or conservation. Places for outdoor classes in sketching may be desirable.

c. Whether such features should be included in school site plans is a matter of local program requirements and of local decision. It is suggested that the site plan at least leave opportunity for future development along these lines.

43.7 COOPERATIVE SITE DEVELOPMENT FOR COMMUNITY WIDE PROGRAMS

a. Under Minnesota Statutes, Chapter 471, Sections 471.15 through 471.19, school boards and municipal agencies may cooperatively acquire, equip, and maintain land, buildings or other recreational facilities, and expend funds for the operation of a public recreation and playground program.

b. Any joint planning by school board and municipal agencies for the development and use of recreational facilities requires that the legal, fiscal, and administrative powers of the agencies concerned be defined, understood, and mutually accepted.

c. For further reference to cooperative site development for community wide programs see the basic guide developed by health, physical education and recreation educators (National Facilities Conference) "Planning Facilities for Health, Physical Education and Recreation" published by the Athletic Institute Inc., Chicago 4, Illinois.

44-49 Reserved for future use.

SECTIONS 50-69. ELEMENTARY SCHOOL INSTRUCTIONAL FACILITIES

Section

50.0 ELEMENTARY SCHOOL FACILITIES, GENERAL

50.1 Organization and Program. Elementary school building facilities are provided, for the most part, for programs in the kindergarten and grades 1–6. The state curriculum outlines and suggested courses of study constitute the basis for the elementary curriculum, with the necessary modifications to adapt them to local needs. Constant subjects in the elementary curriculum are:

Language Arts: reading, library, language, handwriting and spelling.

Arithmetic (mathematics).

Social Studies: history, citizenship, geography.

Fine and Practical Arts: art, music, creative dramatics, crafts.

Health, Physical Education and Safety.

In grades 1–6, the usual plan of classroom organization provides for a teacher assigned to and responsible for a specific grade group in a classroom throughout the school day and for the entire school year. Only a few activities such as physical education, library use, assembly and school lunch take place outside the classroom. Pupils are active as a class unit, several groups, or as individuals. However, the introduction of new media of instruction, such as television and audio-visual aids, and new techniques of teaching, such as team or coordinated teaching, have influenced both the plan of organization and implications for classroom design.

50.2 Building Centers or Areas Needed to House the Elementary Program

a. **Instructional Spaces** needed will include:

(1) Classrooms, largely self-contained.

(2) Instructional Materials Center: library, audio-visual, and materials production areas.

(3) Arts Center: art and crafts, music and dramatic activities. Will involve an auxiliary instruction room and assembly area, usually a multipurpose room.

(4) Physical Education Center: Indoor and outdoor physical education and activities areas. Will involve a gymnasium or multipurpose room and outdoor "games" area.

(5) Special Education Area: facilities for educable mentally retarded and other educable handicapped children requiring special facilities; facilities (where local programs exist) for trainable mentally retarded children.

(6) Remedial center: for speech correction, remedial reading, and other desired areas.

b. **Administrative and Service Spaces** supplementing the instructional spaces will include:

(1) Administrative Center: Office(s) for administrative personnel, health unit, teachers' work room.

(2) Receiving and Storage Area: furniture, textbooks, supplies.

Section

(3) School Lunch and Kitchen Areas.

(4) Toilets and Building Service Spaces.

50.3 School Size. The number of classrooms that should be provided in an elementary school building project will depend on:

(1) The ultimate potential enrollment in the attendance area.

(2) The maximum class size as determined by local and state school authorities.*

(3) The normal distribution of pupils in the several grades.

---

*Minn. Reg. Edu 23 (b) states that an acceptable *maximum* class size for elementary pupils is 30 pupils; for kindergarten, 30 pupils, with 25 recommended as desirable.

50.31 Desirable School Size. While there is no hard and fast answer to the desirable size of an elementary school, there is some agreement among school plant planners on two sections per grade k, 1–6 (about 14 classrooms) as desirable, and on three sections per grade (21–24 classrooms) as a desirable maximum.

In densely populated urban and suburban areas and in large rural districts where a large proportion of the grade school pupils are transported by bus, some school officials consider larger schools quite practical, feeling that schools of 1000–1200 pupils (30–40 classrooms) provide a more economical use of special facilities, services, and site.

50.4 Reference to Other Sections. Sections 51–69 following describe instructional facilities in the elementary school building. For other sections of the Guide applicable to elementary schools, see the following:

1-39	Responsibilities and Procedures in School Plant Planning
40-49	The School Site
100-109	Central and Auxiliary Facilities: Administration Unit, Auditoriums and Stages
110-119	Service Facilities: Mechanical Electrical Equipment Service, Custodial Services, School Bus Garages
120-289	Safety, Health, and Engineering in Constructing School Buildings: Fire and Life Safety, Structural Design, Sound Control, Lighting and Fenestration, Plumbing Design and Sanitary Fixtures and Trim, Heating and Ventilating, Electrical Design, Preparation of Plans and Specifications.

51.0 ELEMENTARY CLASSROOMS

51.1 General. The design of the elementary classroom should proceed with the major desired learning outcomes in mind. These include: the development of the basic skills, opportunities to exercise these skills in meaningful situations, and the promotion of physical, social, and emotional growth of the child.

Implementation of the first objective requires well-lighted work areas and work surfaces, ample instructional materials, and convenient storage for these instructional materials. The second objective, that of using skills in meaningful situations, is often secured through units of work or projects with more involvement of pupils in the activities of learning than in the past. This involves a space of sufficient size to accommodate movable furniture and equipment, i.e., movable desks, tables, work counters, bookcases, easels. Fixed equipment will include sinks with desired utilities and some storage cabinets. The third objective infers an upper limit to the size of the class and consequently of the total area of the classroom.

The design of the elementary classroom is affected by the introduction of new media of instruction, such as television, audio-visual aids, and team or coordinated teaching. Television and programmed teaching machines appear to confine the pupils to a fixed area for a period of time. Most new programs point to the need for a fairly large and flexible space.

51.11 Classroom Shape. Classrooms approaching a square or circle seem particularly adapted to enclosing elementary classroom activities, but the final shape of the room will be determined by the outcome of the planning process.

51.12 a. KINDERGARTEN. Based on a room occupancy of 25–30 pupils, 1200 to 1500 sq. ft. of floor area is recommended, including storage, toilet space, and drinking fountain.

b. ELEMENTARY GRADES 1–6. Based on a maximum room occupancy of 30 pupils, provide 900 to 960 sq. ft. of floor area, including work counters and storage space. A floor area of 980 sq. ft. will permit the inclusion of a conference room.

c. GROUPING ARRANGEMENTS. Some school planners would include some instruction areas of varied size, adjacent to each other and with operable dividers. The combination of these spaces, for example, would permit team or coordinated teaching with larger than normal groups. The smaller areas would be suited to small group activities or instruction.

NOTE: A "Suggested Layout for the Elementary Classroom" is obtainable upon request from the School Plant Planning section, Department of Education.

51.13 Classroom Ceiling Height. The ceiling height for kindergarten and elementary classrooms should be 8½ to 9 feet.

51.2 THE KINDERGARTEN CLASSROOM

51.21 The Kindergarten Classroom—Elements

a. MAIN ACTIVITY AREA created from the central part of the room—for games, rhythms, indoor play, major construction projects related to social studies experiences in units on home, store, circus, pet shop, etc.

b. WORK AREA for creative efforts with boards, boxes, tools. In this area are found work tables, benches of suitable size, tool storage cabinet with child size tools, a work sink with hot and cold water, and a storage space for wood and other supplies.

c. ART CENTER for creative efforts with clay, scissors, paper, crayons and paint. Center will provide easels, work tables for clay work and finger painting, storage space for clay, large sheets of newsprint, tagboard, and colored paper, paints, brushes, paste jars, and other art materials.

d. SCIENCE CENTER for activities such as planting and watching things grow, conducting simple experiments, and observing natural phenomena. Center may have an aquarium, terrarium, display space for science and nature study materials, and storage space used for equipment in simple experiments.

e. LIBRARY CENTER for experiences such as listening to and telling stories, examining books. Center will be located in a relatively isolated and quiet section of the room, providing a library table and chairs, and low, open bookshelves suitable in size for large format books.

f. MUSIC CENTER for experiences such as group singing and enjoying music by listening. Center may include a small piano and record player, in any desired spot.

g. TEACHER'S CENTER which should provide desk, chair for teacher, chairs for visitors, file for pupils' records and teaching materials, and closet storage for teacher's wraps and other materials.

h. DRAMATICS CENTER for simple dramatizations; may be provided by a portable platform or simply space in the library corner or music center.

i. MILK BAR OR KITCHENETTE (desirable if bus pupils or community use); may provide a hot plate, with storage suitable to the school milk, snack, or lunch program.

51.22 The Kindergarten Classroom—Supplementary Spaces

a. TOILET, LAVATORY, AND FOUNTAIN FACILITIES

(1) Toilet. A room with a standard size water closet (15″ to rim). Trend is toward a room for boys and a room for girls. Some schools prefer a junior size water closet (13″ to rim).

(2) Lavatory. A lavatory (24″ floor to rim), outside the toilet room adjacent to entrance for easy supervision of handwashing by teacher.

(3) Fountain. A drinking fountain in the classroom (26″ floor to rim).

b. CLOTHING STORAGE ALCOVE. Convenient to outside entrance with open racks or compartments with an upper shelf for hats; clothes rods or hangers for coats (variable heights floor to center 36″–40″); and a lower shelf for boots and overshoes. Some schools prefer movable clothing storage units with cork or tackboard behind, or open racks and shelves in classroom near exit closed off by doors or screens. In every case there is need for teacher control.

c. PUPIL MATERIALS STORAGE. Individual cubicles, sized for intended use; often 12″ x 20″ x 15″. Some schools prefer good storage for pupil materials placed in several parts of the room.

Section

d. Storeroom

(1) One for bulky types of indoor equipment such as construction blocks, cots or mats, looms, easels, supplies.

(2) One convenient to play area entrance for outdoor wheeled toys, building blocks, sand toys, garden tools.

e. Play Area. Set aside from the rest of the school playgrounds; sunny exposure; sheltered from the wind; hard surfaced (blacktop or other permanent surface) at least in part.

51.23 The Kindergarten Classroom—Wall Spaces

a. Chalkboard. 8–12 lineal feet (lower edge not more than 24″ from floor); if slate, use first quality natural slate, not dyed.

b. Display. Ample tackboard and some pegboard as room design permits (lower edge not more than 24″ from the floor). At least one tackboard should be low so that children can use it.

Ample hooks and clamps for charts and pictures. These may be placed at the top moulding of the chalkboards and tackboards. Recessed picture moulding may be used on all walls.

c. Clocks. An electric clock should be provided.

d. Outlets. Duplex electrical outlets should be placed so as to encourage the use of radio, record player, and visual aids. One outlet should be provided over the work counter but some distance from the sink.

e. Screen. Provide a roll-up projection screen on a selected wall.

51.24 The Kindergarten Classroom—Other Considerations

a. Mobility. Movable bins, shelves, equipment will encourage flexibility in the classroom. The teacher can arrange room to suit herself and the pupils.

b. Acoustical Treatment. Required. See Sections 170–179, Sound Control.

c. Decoration. Desirable visual environment is enhanced by the skillful use of color. See Sections 193.41, 193.42.

d. Floors. Durable, resilient material, capable of standing up to continuous physical activities of kindergarten children and rearrangement of furniture and movable equipment.

e. Other. Check sections on lighting, heating, ventilation. The need for warm floors suggests consideration of panel (radiant) heating for this room. See Section 234.5.

51.3 THE ELEMENTARY CLASSROOM, GRADES 1–6

51.31 The Elementary Classroom—Elements

a. Primary Classrooms, Grades 1–3. Self-contained except for service of library, gymnasium, assembly and school lunch room. Primary classrooms will usually include:

Section

General work area in which most of the educational process goes on, containing movable desks, seats, tables and chairs, arranged to suit the program.

Reading-study area with chairs, tables, and bookcases, and areas for book display.

Art center with easels and work tables.

Science center with place for aquarium, terrarium, exhibit, and demonstration space.

Work center with counter and sink.

News center with bulletin board where items of interest may be displayed.

Teacher's facilities with desk, filing cabinet, and closet.

music facilities including record player, records, rhythm band instruments, and possibly a small piano.

Note: Instruction at the primary grade level, grades 1–3, tends to be informal, with the exception of reading until about the end of the second grade. There is a transition to more formal instruction in the third grade.

b. Elementary Grade Classrooms, grades 4–6. Like the primary classroom, these classrooms are largely self-contained. In grades 4–6 there is formal instruction in the constant subjects. See list, Section 50.1.

Major elementary grade classroom centers or elements, grades 4–6, include:

(1) General instructional area.

(2) Facilities for language arts, arithmetic, social studies. These largely involve the general instruction area, wall space, some equipment and storage (maps, charts, etc.).

(3) Facilities for science, art, music, and crafts. These may involve some supplementary space and will require some specialized equipment and equipment storage. See 51.32 c. "Auxiliary Instruction Room" and 51.33 "Wall Space for Instruction, Display and Storage."

(4) Teacher center. Desk, chair(s) in general instructional area. For storage of teacher's personal belongings and resource materials, see Section 51.33 f.

(5) Conference room. May be provided. See suggested layout for elementary classroom, obtainable from School Plant Planning Section, State Department of Education.

Note: There is a definite trend toward offering a modern foreign language in the elementary grades. See "Guidelines for Modern Foreign Languages in Minnesota Schools," Code F-XXXVIII-B-73, and "Guide for Planning Foreign Language Facilities in Minnesota," Code F-XXXVIII-B-133.

51.32 The Elementary Classroom—Supplementary Spaces

a. Toilet Rooms. Toilet rooms directly connected to the classroom are considered necessary for grade 1 and desirable for grades 2 and 3. Many school planners, however, think pupils in grades 2–6 may well use general toilets.

(1) Number of fixtures for primary classroom toilets. See Section 216.26.

Section

(2) Number of fixtures for elementary general toilets. See Section 216.27.

(3) Fixture heights. See Section 218.1.

b. Clothing Storage. The following arrangements are examples of acceptable storage:

(1) Grades 1–3
- (a) Open racks and shelves in classroom near exit closed off by doors or screens.
- (b) Wardrobe type lockers inset in corridor wall, with teacher controlled locking device.
- (c) Open racks and shelves inset in corridor wall (acceptable but least desirable).

(2) Grades 4–6
- (a) Lockers inset in corridor wall, with individual pupil controlled locking device.
- (b) Wardrobe type lockers inset in corridor wall, with teacher controlled locking device.
- (c) Open racks and shelves in classroom or inset in corridor wall.

c. Auxiliary Instruction Room. It is considered advisable by school planners to provide a separate auxiliary instruction room for small class or individual instrumental music instruction, and for larger projects in arts, crafts and homemaking than can be conducted in the elementary grade classroom.

(1) **Number.** There should be at least one auxiliary instruction room for each elementary school building. Buildings with 30 or more classrooms will require two such rooms.

(2) **Size.** Gross floor area of the auxiliary instruction room should be 900 to 1000 square feet.

(3) **Equipment.** Ample storage for instructional materials required.

51.33 The Elementary Classroom—Wall Space for Instruction, Display, Storage

a. Chalkboard. 16–20 linear feet is generally considered sufficient, although some school administrators like up to 32 linear feet (16 feet on each of two walls).

b. Display

(1) **Tackboard.** An abundance of tackboard and some pegboard; all or most of it at the pupil's eye level. In primary grades avoid putting tackboard above sinks or cabinets as it is too high and difficult to change.

(2) **Map and Screen Fixtures.** A picture moulding or map rail which may be recessed, provided with a series of clips or hooks to accommodate roll-up maps and a roll-up type projection screen. The roll-up type projection screen may be permanently placed on a selected wall.

c. Work Counter. 12 or more linear feet; trend toward movable counters that can be placed in any desired position. Counter tops should be durable, stain resistant material such as formica.

Section

d. Work Sink. Should be provided in or near the work counter; room design will determine whether wall or island type.

e. Heights. Chalk rail, lower edges of tackboard, counters, sinks:

Grades 1–2—26 inches from the floor
Grades 3–4—28 inches from the floor
Grades 5–6—30 inches from the floor

Note: Experience indicates that the mobility of school population causes particular classrooms to be used for various class levels in a series of four or five years. There seems to be merit, at least in fast growing areas, in placing all chalkboards and bulletin boards 26 inches from the floor and using 4′ widths, thereby permitting any given classroom to be used for grades 1 through 6.

f. Materials and Equipment Storage. Space must be planned to meet specifications. These will usually include:

(1) **Teacher.** A closet with mirror on the inside of the door, shelves for personal belongings; lock. Filing cabinet(s) for pupil records and resource materials. Cabinet(s) may be recessed.

(2) **Instructional Materials.** A counter height, movable storage unit for consumable supplies and other instructional materials; may be used to subdivide the room for varying activities. Low, movable book cases may be similarly used.

(3) **Language Arts and Social Studies.** Storage for large charts, cards, posters, maps.

(4) **Science and Nature Study.** Storage for glass jars, dry cells, magnets and other simple equipment.

(5) **Arts and Crafts.** Drawer for small supplies; cupboard for larger supplies; large shallow drawers (25″x36″) for 25″x36″ paper; small cabinet with space for roll and cutter for heavy wrapping paper; bin or cubicle for clay.

Note: Clay is now supplied in plastic bags and can be stored in general storage area.

(6) **Handworking Area.** Storage for tools and materials for local program if in the classroom.

(7) **Music.** Storage for records and record player if kept permanently in room; rhythm band instruments in primary grades.

(8) **Physical Education Equipment.** Storage for play equipment normally kept in classroom.

51.34 The Elementary Classroom—Other Considerations

a. Floors. Should be of durable, resilient material which will tend to reduce noise and facilitate the moving of furniture.

b. Decoration. The walls should be in light colors; the ceiling in light reflecting color. See sections 193.41, 193.42.

c. Furniture. Seats, desks, tables, and chairs should be movable, contribute to good posture; metal parts painted with flat enamel of light color; wood surfaces light in color and with flat finish.

Section

d. DAYLIGHT CONTROL. See section 196.2.

e. HEATING AND VENTILATION. See sections 230-253.

f. ACOUSTICAL TREATMENT. See sections 170-178.

g. ELECTRICAL. Check needs, using the following list:

(1) Receptacles (duplex), conveniently spaced and easily accessible for:
  Record Player
  Tape Recorder
  Radio
  Television
  Work Counter (at least 5′ from sink)
  Visual Aids
  Clock
  Aquarium

Section

(2) Chalkboard Lighting

(3) Display lighting

(4) Room Lighting. See Section 193.

(5) Dimmers, permitting workbook and notebook work with audio-visual aids

(6) Intercom System. See Section 257.

(7) A-V Conduit, Wire, etc.

(8) T.V. Aerial

(9) Clock (Suggested location: above exit door)

(10) Radio Aerial

(11) Buzzer, Bell

(12) Closed Circuit T.V.

SECTIONS 52-53. THE INSTRUCTIONAL MATERIALS CENTER

Section

52.00 GENERAL. It is recommended that an INSTRUCTIONAL MATERIALS CENTER or CENTERS (Library and Audio-Visual Education) be provided in every new elementary building. This permits the full and effective use of known media of instruction and new media as developed.

52.01 Instructional Materials Center. In the Instructional Materials Center, a media specialist directs both the library service and the audio-visual education program for the effective use of teachers and pupils. The specialist has preparation in both the library and audio-visual education fields. See Section 72.01 a. for space relationships and broad functions of the Instructional Materials Center.

52.02 Library and A.V. Education Centers. The two major centers are (1) Library and (2) Audio-Visual Education. The goals of the two major centers are the same as for the "Instructional Materials Center," but administration is less centralized. The librarian directs and operates the library center. The building A.V. coordinator is in charge of the local A.V. Education program. Effective coordination is attained through the elementary principal, superintendent, or some other administrator, such as a curriculum supervisor in a large school. See 72.01 b.

52.03 Major Facility Areas. The library and audio-visual education areas are adjacent or near to each other. Major facility areas may include:

a. Library

- Entry (circulation area)
- General reading
- Periodicals
- Individual work-study and research
- Listening
- Conference
- Receiving
- Workroom-storage
- Office (large school)
- Textbook storage (optional)

b. Audio-visual Education

(1) A-V Education Service:
  - Distribution area
  - Equipment area
  - Materials storage
  - Inspection and repair
  - Preview and auditioning area
  - Office (large school)

(2) Materials Production:
  - Planning and producing area
  - Reproducing area:
    - Reflex copy
    - Ditto, mimeo., etc.

52.04 Planning Facilities. Recommended standards are stated in the sections which follow to assist school planners in designing facilities and providing adequate spaces for functional instructional materials and equipment services.

52.0 THE LIBRARY

52.1 FUNCTIONS

52.11 General. The need for a wide variety of books and other materials on the many reading and ability levels of pupils, makes the library center an essential part of the instructional program in the elementary school.

Section

The library provides for individual differences and for the stimulation of new interests. The library can plan an important part in reaching the slow reader, in meeting the needs of the average reader, and in challenging the gifted. Collections of library materials are circulated to classrooms as needed, and provisions made for the circulation of books and other library materials to individual borrowers.

52.12 Planning Principles. Design to provide for the following functions:

a. Organization, housing, circulation, use and display of a collection of books and related instructional materials in a reading room centrally located and accessible to pupils and teachers.

b. Seating in the reading room for one, and in large schools two, normal size classes plus additional seating for individuals. Provision should be made for two class groups when enrollment exceeds 540 pupils.

c. The processing and repair of library materials; related storage.

d. Conference room for project work. May have multi-use for previewing and auditioning.

52.2 PLANNING LIBRARY QUARTERS. The basic elementary library quarters consist of a reading room, work-storage area, and a conference room. In schools with more than 750 pupils, these basic areas should be supplemented by additional space for a preview and listening room, a professional library and teacher's work area, and a space for a librarian's office. In a district with several elementary schools, one central area for ordering, processing, and cataloging books is desirable. See also section 52.45 and suggested layouts, Department of Education.

NOTE: For combination schools, housing grades K, 1–12, see section 52.32 for suggested floor area for seating, bookshelving, and circulation. The reading room should be arranged to provide specifically for lower grade pupils (grades 1–6).

52.21 Location. Library quarters should be located: (a) for economical future expansion, (b) accessible to all pupils and teachers, (c) away from noisy areas of the building or playgrounds, (d) for easy coordination with audio-visual center or area.

52.22 Administration. Library quarters should be under the supervision of the librarian. All rooms therefore, should be adjacent and provide easy inter-communication with the reading room. The reading room should have only one entrance for general use.

52.3 READING ROOM. This area is used by pupils individually and by groups, large or small. Books, magazines, and a variety of other printed materials may be housed and displayed here. An informal area for story telling and book sharing should also be provided.

Section

52.31 Arrangement

a. The CHARGING DESK should be located in proximity to the entrance and the work room.

b. All available WALL SPACE should be used for shelving. The use of outside walls for some standard height shelving is strongly recommended.

c. TABLES may be rectangular (3 by 5 feet), round (4 feet in diameter), or individual (29" by 39"). Four chairs per rectangular or round table should be provided, with spacing of tables as follows:

5 feet between tables, with or without chairs.
5 feet from table to face of shelving.

d. EXPANSION. In the past, many elementary libraries have been designed to accommodate the pupils in 12 classrooms, but later when the building was enlarged to 18 or 24 classrooms, the size of the library was inadequate. It is recommended that in growing cities or suburban communities, the library reading room should be large enough to serve the enrollment in at least 18 classrooms (about 540 pupils) even if only 6 or 12 classrooms are being initially constructed.

Section

e. WINDOW AREAS. Wall space needed for book shelving should not be sacrificed to large window areas. See paragraph b. above.

f. FLOOR. The floor should be covered with resilient, noise reducing material such as carpeting, rubber or vinyl tile. Sunken floors are not recommended because they decrease the flexibility of the room, create hazards, and prevent the effective use of book trucks.

g. ELECTRICAL OUTLETS. Provide at least two electrical outlets on each wall for the use of various kinds of audio-visual equipment. Locate outlets preferably in base of shelving units for easy accessibility.

NOTE: For suggested layout for Elementary School Library Quarters, write to the School Library Unit or the School Building Planning Section, State Department of Education.

52.32 Standards for Seating Capacity, Floor Area, Book Collection, Shelving. Figures for seating, gross floor area, book volume capacity, and bookshelving are shown in Table 52.32 a. following.

TABLE 52.32 a. STANDARDS FOR SCHOOLS

ITEMS	SCHOOL SIZE 12–17 Classrms. 160–510 Pupils	 18–23 Classrms. 540–690 Pupils	 24–30 Classrms. 720–900 Pupils
SEATING CAPACITY: Seat at least 2 grade sections (60 pupils)*	60	60	70*
FLOOR AREA: Allow 30 sq. ft. per pupil when enrollment exceeds 500 pupils	1500 (Min.)	1800	2100
BASIC BOOK COLLECTION: At least 10 titles per pupil enrolled	6000 (Min.)	7000	9000
Standard Size Books: ⅔ to ¾ of basic collection	4000–4500	4666–5250	6000–6750
Picture Books: ¼ to ⅓ of basic collection	1500–2000	1750–2334	2250–3000
SHELVING REQUIREMENTS (Lineal ft.)			
Standard Shelving: @ 10 books per lineal foot# 8" deep shelves; 5'–6' high; 5–6 shelves per section; 3' wide sections; 30" high for double face counter shelving.	400–450	466–525	600–675
Picture Book Shelving: @ 20 books per lineal foot# 10" to 12" deep; 14" between shelves; 3' wide sections; dividers every 6 inches.	75–100	88–117	112–150
MAGAZINE COLLECTION: Minimum number of titles	25	25	25
Magazine Shelving: Minimum lineal feet# 10"–12" deep; 6' high sections; 3' wide sections.	21	21	21

*Seating 10% of enrollment is desirable for schools with over 500 pupils.
#Adjust indicated lineal feet to full 3' sections.

Section

52.33 Equipment. As follows:

52.331 Shelving. See section 52.32. For detail, refer to suggested layouts for Elementary School Libraries which may be obtained from the School Building Planning Section or School Library Unit, State Department of Education.

52.332 Tables and Chairs. All elementary libraries need tables and chairs of varying heights to accommodate pupils of both the lower and upper grades. Tables of different shapes help to create an informal atmosphere. Where space is available, a window seat adds to the seating capacity of the room and also to its attractiveness.

TABLES	Table Height	Table Width	Table Length	Chairs: Seat Height
Rectangular	26″–28″	3′	5′	13″–15″
Round or square	25″–28″	4′ (diam.)	4′	13″–15″
Individual	25″–28″	29″	39″	13″–15″

NOTE: A tilt top table with a bench is an optional item.

52.333 Circulation Desk and Chair. For the circulation of all materials, provide a desk of standard height which includes a sunken charging tray area (the tray must be purchased), shelf space for the returned books, a drawer or two for cards, stamp pads, and a few other supplies, and at least one knee hole space. Desk should not be fixed to floor or built in.

52.334 Card Catalog Case with Base. Use standard library equipment only. Sectional cases are recommended, with a minimum of ten drawers for the smallest school. In all but the smallest school an additional case will be needed in the workroom for the shelf list.

52.335 Vertical Files. At least one and preferably two four-drawer, legal size cases are needed in the smallest school, one for pictures, the other for pamphlets; additional cases are needed as the enrollment increases.

52.336 Book Truck. At least one book truck should be provided even in the smallest school, sturdily constructed for long wear, equipped with ball-bearing, hard rubber wheels, two of which are on swivels. Trucks with slanted shelves are available and are especially useful for taking books to classrooms or for display purposes.

52.337 Dictionary Stand. Where low sections of shelving are used for ready reference books, a revolving dictionary stand can be placed at one end; in larger libraries a separate stand is desirable.

52.338 Display Areas

a. TACKBOARD OR PEGBOARD mounted in frames and inserted temporarily into shelving sections can be placed in various parts of the room and relocated periodically as desired. Do not place a display unit near the library entrance door because pupils looking at it will block the passage.

DO NOT install permanent display boards on wall space needed for shelving.

b. WALL TYPE DISPLAY CASES facing the corridor outside the library are useful for publicizing its resources. Cases should be recessed, well-lighted, and provided with locks, a combination of tackboard and pegboard backing, and appropriate shelving such as glass. A case 4′ x 4′ x 18″ deep is recommended.

Section

52.4 WORK AREA

52.41. Use. This room serves as a work area and storage facility for supplies, books, and back issues of magazines. This is where new books and other materials are received, cataloged and processed for the shelves. Books are mended and materials made ready for binding. In some elementary schools this area may also serve as the work-storage area for audio-visual materials and equipment, i.e., where space for an audio-visual unit is not provided. See section 53.0 on audio-visual education facilities in the elementary school.

52.42 Space. A work and storage area of at least 160 square feet of floor space should be provided for the smallest school. Proportionately more space is needed as the enrollment increases or if the area is to house audio-visual materials as well. For each 100 pupils over 200, increase the space about 20 square feet.

52.43 Location. The work area may be a part of the library reading room provided it does not take space needed for pupils and teachers. It should be separated from the reading area by movable, free-standing double-faced shelving of standard height. This arrangement provides a degree of flexibility not possible with a fixed wall partition.

NOTE: The main entrance should be located for easy accessibility near the work-storage area and charging desk.

52.44 Equipment. See section 72.44. For location of equipment when work and storage area is placed in the reading room, see elementary school library layouts obtainable from the State Department of Education.

52.45 Processing Center. In a district where there is more than one elementary school, it is desirable to have one central area for the ordering, processing, and cataloging of materials for all schools. When this work area is located in one of the elementary schools, the library workroom will need to be TWICE as large as that for the smallest school (52.42). Conversely, the workroom area in the other schools can be kept at minimum.

52.5 CONFERENCE ROOM. An area of about 120 square feet, separated from the general reading room by a partition and door, will provide space for small groups or committees of pupils coming to the library to work on projects. There should be clear glass in both the door and partition. For further detail as to space, location and equipment, see section 72.6.

52.6 LIBRARIAN'S OFFICE. In large elementary schools of 750 pupils or more, or 24 classrooms or more, a librarian's office should be provided. If needed, see section 72.8 for detail.

53.0 THE AUDIO-VISUAL EDUCATION CENTER

53.1 ORIENTATION. The audio-visual education center or unit should be centrally located adjacent or near the library unit.

Section

53.2 Personnel. The audio-visual education program in the elementary school building is administered by an A-V coordinator or teacher-coordinator who works under the direction of the audio-visual director for the school system.

53.3 Service Areas. The audio-visual center or unit in the elementary school building may be a one-room unit providing space for the following basic areas:

(1) **Receiving, booking and distribution area.** Contains a charging desk and the necessary catalog and reference files.

(2) **A-V materials storage area.** Provides space for the necessary racks, cabinets, drawers, cubicles and other storage equipment for such materials as films, film strips, tape and disc recordings, slides, transparencies, pictures, posters, maps, charts, etc. Locate the A-V materials storage area for distribution of materials by either A-V coordinator or library personnel.

(3) **A-V equipment storage area.** Provides space for audio-visual equipment, including stand-by and reserve units, which are to be circulated to teaching stations: (a) on carts—a variety of projectors, record players, T.V. receivers, etc., (b) portable equipment—P.A. system, microphones, teaching machines, extension cords and related equipment.

(4) **Inspection and repair area.** Provides space for work counter with electrical outlets, tool panel, storage for parts and for stand-by equipment.

(5) **Preview and auditioning area.** Provides wall projection screen and light control devices for previewing purposes and space for auditioning records and tapes.

(6) **Faculty work area** (for planning and producing teaching aids and reproducing printed materials). Provides space for work counter and layout table, sink, electrical outlets, tools, tool cabinet; duplicating machines; and storage for construction and duplicating supplies.

Note: See section 73.0 The Audio-Visual Education Center (secondary school) for a more detailed discussion of these basic areas and additional areas as provided in the district audio-visual education center.

Section

53.4 Suggested Space. For an audio-visual education unit providing the areas listed in section 53.3 preceding:

Elementary school building of 18–24 teachers—about 435–525 sq. ft.

Elementary school building of 30–40 teachers—about 840 sq. ft.*

*In elementary school buildings with 30–40 teachers, consider the advantages of an auxiliary A-V storage unit in another wing of the building rather than providing one classroom size unit. A good practice in all schools is to provide auxiliary A-V storage space on every floor level not served by an elevator.

53.5 Audio-Visual Education Equipment. Not all of the equipment in the inventory of the audio-visual education center needs storage. Certain equipment items such as overhead projectors, tape recorders, filmstrip viewers, filmstrip and slide projectors, used almost daily in the classroom, may be assigned to teachers for varied periods of time, in some cases for six or more months or the entire year. All items assigned to classrooms are recalled for periodic inspection and necessary repair.

Note: A basic minimum list of audio-visual education equipment needed in a good instructional program may be found in the "Administrative Manual for Minnesota Public Schools," Part II, Section 5.00, or may be obtained from the state supervisor of audio-visual education.

Equipment List. The purpose of the list below# is to indicate some of the types and kinds of equipment and a suggested number of each for which storage facilities are needed in the elementary school audio-visual education center. The list is only representative of the total A-V equipment needed in a building for program purposes.

53.6 Layout. A suggested layout for an audio-visual center or unit for an elementary school building may be obtained upon request from the School Building Planning Section or Audio-Visual Education Unit, State Department of Education.

#AUDIO-VISUAL EQUIPMENT	MINIMUM NUMBER OF ITEMS
(1) 16 mm sound motion picture projector*	1 per 240 pupils or 8 teachers
(2) Film strip 2 x 2 projectors	1 per 90 pupils or 3 teachers
(3) 8mm silent and/or sound projectors	1 per 180 pupils or 6 teachers
(4) Overhead projectors*	1 per 180 pupils or 6 teachers (as stand-by or reserve equipment)
(5) Opaque projector*	1 per building
(6) Record player (4 speed)	1 per 90 pupils or 3 teachers
(7) Tape recorders*	1 per 180 pupils or 6 teachers
(8) Microprojectors	1 per building
(9) Radio receiver	1 per building
(10) T.V. receivers*	4–6 per building
(11) Projection screen (portable)	1–2 per building
(12) Projection carts	3–4 per building
(13) Direct wire T.V.	1 per building

---

*On carts. Provide space in storage room for cart and attached equipment.

SECTION 54.0 REMEDIAL READING AND SPEECH CORRECTION CENTER

Section

54.1 GENERAL

a. Correction of reading defects is a matter of continuous individual or group instruction of a remedial nature which is the responsibility of every school.

b. The following material is suggestive of the minimum facility needed in an elementary school and/or in a junior high school. It may be modified for larger schools.

54.2 LOCATION. Remedial room should be in a quiet area, adjacent to or near the library.

54.3 SIZE AND DIVISIONS. A space of about 450 to 500 sq. ft. is recommended, divided to include:

a. A teaching room for remedial reading or speech correction, and

b. A small conference or work room, 90 to 100 sq. ft., separated from the teaching center by a partition with vision window and with access from the teaching center by a small vestibule.

NOTE: See suggested layout for remedial reading and speech correction center for elementary and junior high schools, obtainable from the School Plant Planning Section, State Department of Education. If room is to be located adjacent to library, see suggested layout for elementary school library obtainable from the same source.

54.31 Teaching Center. Provide:

a. In INSTRUCTION AREA: tables, individual chairs, portable 3′ x 4′ chalkboard with stand. If multiple use for speech correction is planned, provide mirror, chart holder, and storage for special equipment and materials.

b. WALL SPACE

(1) On one wall—about 12′ of chalkboard, two 4′ sections of tackboard, and some pegboard adjacent to entrance door. Provide a vestibule, about 10′ x 5′, with access to both the teaching center and the work or conference room.

(2) On the opposite wall (partition to exterior window wall):

(a) Work counter, about 8′, with sink and bubbler, tackboard above counter, bin drawers and storage space equipped with sliding doors below, and

Section

(b) Book shelving unit, about 10′ long and 6′ or 7′ high, providing three sections of book shelving, slanting magazine shelf, and picture book shelving below.

(3) Additional 8 inch book shelving below the partition window (low transmission or one-way glass) on the partition wall separating the teaching center and conference or work room.

(4) (Optional) Additional 8 inch book shelving below window on exterior wall.

54.32 Conference or Work Center

a. In WORK AREA: conference table and chairs.

b. WALL SPACE

(1) On one wall:

(a) A counter type storage unit, about 7′-6″, containing files for cumulative records; machine storage cabinet equipped with sliding doors for tape recorder, slide or film projector, and tachistoscope.

(b) Above the storage unit, cabinets for tests and supplies (the full length of the upper wall except for space for open coat rack between the entrance door wall and storage unit).

(2) On an adjacent wall (storage cabinet to partition) —chalkboard the full length of the wall.

(3) Below the partition window—8 inch book shelving.

(4) On the entrance door wall—tackboard from door to partition.

54.4 ELECTRICAL OUTLETS

a. TEACHING CENTER: Provide three duplex receptacles —two wall and one above the counter at least 5′ from sink.

b. CONFERENCE OR WORK ROOM: Provide two duplex receptacles—one wall and one above storage unit.

54.5 OTHER CONSIDERATIONS

a. Lighting should be the same as in sight saving rooms—150 maintained footcandles.

b. Provision should be made for darkening the teaching center for use of audio-visual equipment.

SECTION 55.0 ELEMENTARY MUSIC FACILITIES

55.1 PROGRAM. Space, acoustics, and equipment must be provided for the music program in the elementary classroom. The program includes singing, listening to music, learning notation and fundamental rhythms, and relating music to other subjects.

55.2 SCHOOLS WITH 18 OR MORE CLASSROOMS. In elementary schools with 18 or more classrooms, instruction in elementary music and participation in vocal groups or choruses larger than a classroom group is commonly offered. In such schools a specialized general-purpose music room should be provided. In schools with 30 or more classrooms there may be need for both a specialized instrument rehearsal room and a vocal rehearsal room.

55.3 GENERAL-PURPOSE MUSIC ROOM. This room, exclusive of storage, should be about 1000 sq. ft. in area with ceiling height of 12– to 14′ to accommodate an instrumental group of some 40 pieces or a chorus of 80–90 pupils. The use of risers will reduce the number of choral pupils that can be accommodated.

55.4 MUSIC STORAGE. The general-purpose music room should have storage adjacent for school owned instruments and music. Music may be stored in a lockable file and instruments in cabinets or lockers with individual locks for each instrument compartment. If the size of the general-purpose music room is increased, instrument storage may be provided in cabinets or lockers in the room.

NOTE: For a detailed description of general purpose music rooms, instrument rehearsal rooms, and vocal rehearsal rooms, see Section 78.0 "The Music Unit" (Secondary Schools).

SECTION 56.0. PHYSICAL EDUCATION UNIT

56.1 Basis for Planning. The required number of teaching stations is the basis for planning of both indoor and out door physical education spaces and facilities.

a. A teaching station is a space of sufficient size to accommodate one group for physical education activities to be taught by one teacher.

b. Class size of 30 pupils per group is used in planning for elementary grades.

56.11 Formula. The number of teaching stations can be determined by the use of the following formula:

$$\text{Number of teaching stations} = \frac{\text{Total number of periods of use each week by all groups}}{\text{Total number of periods available each week in one teaching station}}$$

$$\text{Total teaching stations} = \text{Number of teaching stations} \times 1{:}25^{*}$$

*Schedule Efficiency Weighting Factor (introduced in formula to meet administrative problems in scheduling, future growth, etc.)

a. Fractional teaching stations should be considered the next higher whole unit.

b. Before calculations are undertaken, care should be taken to establish firm data or policies relative to each item in the formula. For example:

(1) State standards for physical education require a 30 minute daily period for grades 1–6 (25 plus 10 minutes grades 1–2), 5 days a week.

(2) In a six-hour day, twelve 30 minute periods are available for scheduling. In actual practice, due to conflicts, there may be fewer usable periods.

(3) Physical education educators recommend that a 50% additional allowance be added to the calculated physical education teaching stations for recreational needs for elementary children. However the local recreational program and other possible provisions for recreation will determine the need for and the extent of this allowance.

56.12 Application of Formula. Elementary school, grades 1–6, 13 classrooms, average class size—30 pupils, 5 daily periods per week; twelve usable physical education periods daily (30 minutes each). Refer to 56.11.

(1) $\text{Number of teaching stations} = \frac{\text{13 groups x 5 periods each}}{\text{12 x 5 (periods available)}} = \frac{65}{60} = 1.08$

(2) 1.08 teaching stations x 1.25 (Weighting Factor) = 1.35

(3) 1.35 plus any allowance for recreation. Example: 50%.

(4) 1.35 plus (1.08 x .50) .54 = 1.89 teaching stations.

(5) The figures 1.35 (item 2) and 1.89 (item 4) indicate that two teaching stations should be considered. These can be provided by one gymnasium divided into two teaching stations by a folding partition.

56.2 Size of Physical Education Units. Suggested indoor physical education units for schools of various sizes are:

56.21 Elementary Schools, Grades 1–6, 4–10 Classrooms. A gymnasium unit not less than 40 feet wide by 60 feet long (inside dimensions) with ceiling height of 16′ to 18′ is recommended. This would provide one teaching station with adequate space for volleyball, newcomb, badminton, paddle tennis, etc., and 30′ circle area for dodgeball and circle games.

56.22 Elementary Schools Grades 1–6, 12–16 Classrooms. The gymnasium unit suggested for such schools is 52 feet wide by 72 feet long with a ceiling height of 16′ to 18′ which, when divided by a center folding partition, will provide; two teaching stations 36′ x 52′, one 40′ x 66′ intramural basketball court, one 30′ x 60′ area for volleyball, newcomb, etc., three 20′ x 44′ areas for badminton, paddle tennis, etc., and two 30′ circle areas for dodgeball and circle games. To provide three rows of folding bleachers on one side of the gymnasium, if desired, add 2′ to width.

56.23 Elementary Schools, Grades 1–6, 18–24 Classrooms. Schools of this size require three teacher stations for physical education activities. It is suggested that such schools provide gymnasium with a floor area 60 feet by 80 feet and ceiling height of 18′ to 20′ with 16′ minimum. This space, when divided by a center folding partition, provides for: two teaching stations, each 40′ x 60′, one 42′ x 72′ official junior high school basketball court for school and neighborhood use, one 30′ x 60′ official court area for volleyball, newcomb, etc., two 30′ x 50′ non-official courts for volleyball, newcomb, etc., three 20′ x 44′ court areas for badminton, paddle tennis, etc. and two 30′ circle areas for dodge ball, circle games, etc. To provide six rows of folding bleachers on one side of the gymnasium seating approximately 350, if desired, add 4′ to the width.

The third teaching station can be provided in a multipurpose room designed for school lunch and primary grade physical education activities. (57.1)

56.3 Additional Characteristics of Physical Education Unit.

56.31 Floors. Floors should be resilient and non-slippery; hardwood or composition. Suitable floor plates and anchors for gymnasium equipment should be put in when the floor is laid. Floor opening should have cover plates to exclude dirt. Floor markings will include court markings for basketball, volleyball, badminton, and circles for dodgeball, circle games, group dancing, and other activities.

56.32 Walls. Nothing should project from the walls into the play area. Walls to a reasonable height should be finished with non-abrasive and impervious materials.

56.33 Apparatus. Included may be climbing ropes and poles; basketball backboards for practice games; basketball backstops for major court; volleyball facilities with provision for fastening net; horizontal bar; horizontal ladder; stall bars. Provision should be made for hanging and removing apparatus that is normally attached to the ceiling.

56.34 Drinking Fountains. Provision should be made for recessed drinking fountains.

Section

56.35 Doors. Doors should open out directly on the playing floor and be without glazed areas. They should not open near the main basketball goals. Sufficiently large doors without thresholds should be provided for any major storage spaces.

56.36 Clock. Each physical education unit will require a clock with screened face for protection from various kinds of balls.

56.37 Scoreboard. Not necessary for elementary school purposes but desirable if gym used for community adult and teen-age games.

56.38 Phonograph and Loudspeaker Equipment. Equipment may be portable or permanent to avoid theft or breakage. A built-in cabinet may be provided to house electric record player and records (or tape recorder); compartment about 20" deep, 24" high and 48" wide equipped with doors that lock. It should contain a microphone jack. Two 12" loudspeakers should be installed, one at each end of the room, so arranged that they can be used separately or together.

56.39 Other

a. NATURAL LIGHTING. In general, windows in the gymnasium are not desirable. If windows are desired, they should be small individual units, north orientation if possible; no windows behind basketball backstops because of glare; shatter resistant glass; screened if necessary; 8–12 feet or more above the floor; daylighting control provided. The use of low transmission glass may be desirable.

b. ARTIFICIAL LIGHTING. Electric lighting without shadows is needed. See Sections 193.3, 194.0.

c. EXIT LIGHTING. See Sections 125.101–125.106.

d. VENTILATION. Mechanical ventilation required. See Section 252.0.

e. SOUND CONTROL. Should be maximum deadening of play and game noises. See Section 177.1 for acoustical treatment to be provided.

56.4 AUXILIARY PHYSICAL EDUCATION SPACES. These will vary widely from school to school and also by size of schools. Selections will be possible from the following:

56.41 Shower and Locker Provisions. At or about the age of the average fifth grade pupil, physical education activities are directed toward more highly organized and more vigorous games. At this time, physical education educators recommend that pupils begin to wear gymnasium uniforms and to take showers so that they may return to the classroom free of perspiration odors. Accordingly, elementary schools may have locker rooms and suitable showers to accommodate at least the fifth and sixth grades. If considerable out-of-school use is contemplated for youth and adults, additional shower and locker provisions should be included and the installation serve both the school and community.

a. Where local needs justify the installation of these facilities, these areas should include space for dressing, lockers, shower facilities, benches and mirrors with shelves, toilets, handwashing facilities, and drinking fountains.

b. The following shower specifications are suggested:

Section

(1) One shower head for each 4 boys.

(2) Gang showers recommended for girls in the ratio of one shower head to three girls; one or two individual shower stalls provided with dressing cubicles.

(3) Each gang shower head individually controlled and flush wall mounted.

(4) A practical means of soap dispensing. Some schools use a liquid soap dispenser or outlet placed at each shower.

(5) Floors of non-slip tile or other non-absorptive material.

(6) Sufficient floor drains—at least 2.

(7) Shower head heights: 50 inches—girls; 55 inches—boys.

c. Dressing or street lockers should be large enough to accommodate street clothes; one dressing locker for each pupil in the largest class section.

d. An individual storage locker is needed for each pupil participating in physical education. The ratio of individual storage lockers to each dressing locker is determined by the number of daily periods scheduled for physical education, i.e., if six such periods, 6 storage lockers would be combined with 1 dressing locker. Combined dressing-storage locker unit arrangements should be planned as a coordinated unit of uniform height. Example:

	W	D	H	
1 single tier dressing locker..........	12"	x 12"	x 60"	(1)
2 rows of 3 tier storage lockers.......	9"	x 12"	x 20"	(6)

NOTE: Any desired combination of standard widths, depths, and heights may be used, provided the units match to furnish a uniform height.

e. Lockers should be placed in a solid coved base 6" to 8" above the floor. Distance between rows of lockers, permitting two rows or dressing benches should be at least 8′. This permits a distance of thirty inches from bench to locker. Benches should be secured to floor; seat boards of hardwood, 8" in width, height of bench 15" or lower.

f. Minimum toilet facilities:

(1) Boy's room—1 watercloset, 2 urinals, 1 lavatory.

(2) Girl's room—2 waterclosets, 1 lavatory.

56.42 Physical Education Instructor's Office. In schools with one instructor, one physical education instructor's office should be provided; in schools with instructors for boys and for girls classes, one office for each sex.

About 120-150 square feet will provide space for locker for personal apparel and equipment; files for charts and records; first aid cabinet; cot for the injured; and supply storage bins for balls, bats, and small equipment. In larger schools it is desirable to include a shower-dressing unit, about 100 square feet, in each office. This unit would provide a shower, toilet and lavatory. The office should be accessible from the gymnasium, locker dressing room and playground.

56.43 Central Storage Space. A minimum of 200 square feet opening into the gymnasium, provided with hooks for hanging mats; shelves and bins for game materials; and storage for other special school programs using the physical education unit.

56.44 Playground Storage. Locate accessible from the playgrounds, as near as possible to central storage space, minimum dimensions 10' x 10' with open shelves 15" deep, with 2" retaining front strip. At least 6' should be without shelves for general storage.

56.45 Toilets for Physical Education Unit. If physical education unit is used extensively for other than regular school purposes, it will need toilets for boys and girls directly accessible from both indoor and outdoor play areas. Criteria to be met are: segregation, well separated entrances, ease of supervision, and possibility of separation from the rest of the building. A separate toilet should be provided for instructors if there is no ready access to other adult toilets.

56.5 Outdoor Facilities Needed

56.51 Specific Areas for Elementary Schools

a. Hard-surfaced (Blacktop or other) multiple-purpose area. This all weather area should be laid out with suggested dimensions of 100 x 120 feet. Due to the nature of the surface of this area, it can be used at all times except in inclement weather. It provides for many court activities, such as basketball, volleyball, badminton, tennis, shuffleboard, etc., which require hard, smooth playing surfaces. When separate areas are used for these activities, approximately one acre of permanently surfaced area should be provided.

b. Apparatus area

(1) For physical education. A space approximately 25' by 120' should be provided for: jungle gyms, horizontal ladders, three-section chinning bars, and low bars 30 inches high and 10 feet long.

(2) For free play and recreational use. An additional space approximately 50' by 120' with sand boxes 8' by 12' and other small equipment suited to primary aged children's activities.

(3) Location and characteristics. The apparatus area should be located so as not to break up any large space, and when possible in a shady spot. Ample room around all apparatus should be allowed for safety purposes, but it should not be so scattered as to waste space for group activities. Since it is practically impossible to maintain turf in this area, a surface free from loose stones and covered with torpedo sand or some similar material is desirable. The landing space around the apparatus should be filled with sawdust, shavings, tanbark or some similar type of soft and cushioning material.

c. Softball Area. A space 250' by 250' should be laid out for softball with several backstops, depending on the number of upper grade classes.

d. Field Game Area. This should be an evenly sloped area 180' by 140' which would provide for participation in modified team games such as field ball, soccer, speedball, touch football, etc. For some games this space might be divided into two separate areas of 90' by 140'.

e. Auxiliary Facilities

(1) One high jumping pit with standards; without frame; filled with soft, cushioning material—sawdust, fine sand, shavings. One broad jumping pit with take-off board. The area needed for these two units should be approximately 80' by 120'.

(2) General purpose area. An area of 125' by 150' for informal play activities, for running, and for games of low organization. This area should either be in grass or blacktop surface.

56.52 Outdoor Physical Education and Recreation Areas. The following chart represents the various areas which should be set aside for elementary school playground, overall space necessary for each area, and number of areas to be provided in terms of classroom units in school.

Types of Areas	Recommended Dimensions (in feet)	Space Required (in sq. ft.)	No. of Areas Required for Classroom		
			10	20	30
Multiple-Purpose	100 x 120	12,000	1	2	3
Apparatus	75 x 120	9,000	1	1	1
Horseshoes (optional)	50 x 60	3,000 (2 courts)	1	1	1
Softball	250 x 250	62,500	1	1	1
Field Games	180 x 140	25,200	1	2	3
Auxiliary Facilities	...	28,350	1	1	1
Total Acreage			3.2	4.6	6.6

SECTION 57.0. MULTIPURPOSE ROOMS, INCLUDING STAGE AND ASSEMBLY AREAS

57.1 General

a. Purpose. In large elementary schools, such activities as physical education, school lunch, and assembly are often housed in specialized single-use spaces, each fully utilized for the full school day or week. In smaller schools it is not economical to provide such spaces separately, since any one of them would not be used for a very large percentage of the hours of a school day. Under these circumstances, smaller schools have provided flexible, multiuse rooms, designed, with auxiliary spaces, to accommodate a variety of activities during the school day and out of school hours.

b. Activities Included

(1) School Use. From a study of the school program it can be determined which activities, if any, require single-use space, and which may be included in multi-use spaces both for economy and efficient administration.

(2) Community Use. Multipurpose rooms have value and usefulness for adults of the community and other community uses, providing a place after school hours for parent and teacher meetings, civic group meetings, amateur dramatics, after school children's groups such as Scouts, Campfire, adult recreation activities, and numerous other community activities.

c. Activity Combinations. Some combinations that have been found to be reasonably successful in Minnesota include:

(1) Physical education—assembly
Physical education—assembly—school lunch.

(2) School Lunch—Assembly
School Lunch—primary physical education—assembly.

Note: For details for elementary physical education areas, see Section 54.0 and for school lunch, see Sections 58.0 and 105.0.

d. Auxiliary Activities. Facilities frequently found, in addition to the activity or assembly area, include a stage, kitchen, storage rooms, toilets, showers, and dressing rooms. In very large schools or where there is extensive community use, it may be advisable to provide a ticket booth, coat-check room, and toilets for both sexes.

57.2 Characteristics. Some common characteristics of multipurpose rooms are: convenient location, adequate area, flexibility, adequate storage, and attractive and durable finishes.

57.21 Location. Primary considerations are: (1) convenient entrances and exits for both pupils and parents, (2) access to convenient parking areas, (3) access to service facilities, (4) separate heating and ventilating controls (5) sound isolation from classroom areas, (6) access for community use without opening the rest of the building.

57.22 Area. Including auxiliary rooms—2,400 to 6,000 square feet. A large number are between 2,400 and 3,600 square feet.

57.23 Flexibility. Furniture should be folding, stackable, durable, and sturdy. In dining areas in-wall, folding or roll-away tables should be given consideration, with adequate storage in all cases. Multipurpose rooms used for dining should be separated from the kitchen and serving areas by partitions and doors. Some schools provide portable stages that can be rolled into appropriate storage spaces. Partitions and cabinets can be so constructed that they can be moved to accommodate an expanding program.

57.24 Storage. The architect must know the activities included in the program, the items to be stored, and the dimensions of the various compartments needed. Items may include folding chairs, tables, portable stages, physical education equipment, band instruments, pianos, and a variety of other equipment, furniture materials, and supplies. Storage in the kitchen, including refrigeration and dry storage, should be based upon specific data in that field. See Sections 58.0 and 105.

57.25 Finishes. Multipurpose rooms should be made attractive and functional. Floors should be durable, resilient, and easy to clean and repair. Wainscots of walls should be non-abrasive material. Light fixtures should be guarded and protected. The colors on walls, floors, furniture, and built-in equipment should harmonize. Light reflecting qualities of room surfaces should be within the recommended ratios. See 193.2 and 193.41.

57.3 Stages. Permanent stages are often provided in physical education—assembly combinations, particularly in elementary schools with two or more sections per grade. They are sometimes provided in lunch room—assembly combinations. In such cases, the following recommendations will apply.

a. General. Stages for elementary schools should be at least twenty feet deep or about two-thirds the width of the proscenium opening. A proscenium arch width of about 24 to 28 feet is desirable or about one-half the width of the stage area served. The combined unobstructed space in the two off-stage wings should be equal to the proscenium width times the depth of the stage. Permanent backdrops with a variety of scenes should be available. A microphone should always be ready for use. Two means of exit, with wide doors, to corridor or outside should be assured. Nearby classrooms may be used for dressing rooms. Regular schools toilets should be located in the corridor near the stage. Adequate storage facilities for scenery and properties may be provided off wings.

b. Floor. The stage floor should be hardwood; if community use, hardwood in front, the rest edge-grained soft wood.

c. Curtains. Provision should be made in the stage ceiling for curtains cyclorama, and picture screen. All materials must be flame-proofed. (See Fire Marshal's requirements, Section 135.1.)

d. Sound Control. Sound control is essential to facilitate the use of the stage for dramatic and musical activities.

e. Lighting. The stage lighting should consist of ceiling spotlights in front of the stage and a set of border lights

Side spots will add depth to the stage. A light panel should be provided for controlling the stage and house lights. It should be possible to operate the house lights from backstage, from a point near the location of the motion picture projector, and at a point near the main entrance to the assembly room. Variable light level control of all stage and assembly area lights is desirable.

f. Storage. When planned for community dramatic activities, adequate storage should be provided for scenery, properties and costumes. Large shelving and open space is needed.

57.31 Portable Stages. Some elementary schools are currently being built with movable stages, eliminating the fixed stage area. Such portable stages fit into a recess in the wall of the multipurpose room. A track permits drapes and curtains to be stored along the walls. Lighting is provided by a light bar at the ceiling with outlets and a lighting fixture holder adequate for most elementary school stage productions. The light bar must be sturdily mounted.

57.4 Assembly Area

57.41 Size. Since assembly programs may be presented to primary children (grades 1–3) and upper grade children (grades 4–6) separately, assembly areas seating 200 to 400 pupils will usually be ample. In schools providing combination physical education-assembly units, the floor area required for physical education will usually accommodate about 400 pupils when cleared and folding chairs set up for assembly programs.

57.42 Seating. The use of stackable folding chairs make it possible for the floor to be cleared for physical education, primary play activities and for recreation. Most schools use trucks with wheels of non-marring materials to move chairs to storage room or under stage.

Note: In school lunch-primary physical education-assembly combinations, wall mounted tables and benches are recommended.

57.5 Use of Audio-Visual Equipment by Large Groups

a. Multipurpose rooms should provide for the use of audio-visual materials by large community groups.

b. A projection booth is not necessary in an elementary school. An operating center should be planned to which the projector truck may be wheeled. At this point there should be available an acceptable electric outlet for the projector and for the sound cable of the projector. The sound cable should lead to a convenient loud speaker outlet on the stage or to built-in loud speakers which may also serve as the assembly sound system. If windows are in the area they should be darkened by appropriate light control devices.

SECTION 58.0 THE SCHOOL LUNCH FACILITY

Section

58.01 General. A statement regarding the school lunch facility in the elementary school building follows. A more detailed discussion of the factors involved in planning such facilities and recommended space provision and equipment for school lunch facilities are contained in Section 105.0 of this Guide.

58.1 Factors Involved in Planning

a. Number of Pupils to be Served. Sufficient space should be provided for:

(1) An estimated high percentage of pupils who will purchase a complete Class A lunch under the National School Lunch Program.

(2) An estimated percentage of persons who will bring a prepared lunch from home and supplement it with milk served at the school.

(3) An estimate of faculty to be served in the school facility.

b. The Long Range Food Service Plan Adopted in the School or System. May be:

(1) Complete preparation, service and dining area planned for cafeteria service plus other instructional uses.

(2) Kitchen type of food preparation with dining provided in areas which are used for the major portion of the school day for other purposes, i.e., multipurpose rooms, assembly rooms, classrooms.

(3) Central food preparation for several school lunch departments in a system, with facilities for serving and dining provided in each school.

c. Number of Lunch Periods. A maximum of three periods of not less than 25 minutes each to be used in serving all of the pupils in any one school building is desirable.

d. Type of Lunch to be Served. The service of one complete Type A lunch only will teach pupils to accept a variety of foods, will speed service, and will require less equipment and personnel.

e. Quantities of Food Purchased. In areas where frequent deliveries are available, schools will require less storage than in rural or isolated districts where deliveries may be irregular or less frequent.

f. Extent of Use by the Community. Space for accessory items that may be used by parent-teacher groups and other school community groups should be included.

g. Durability of Materials. Materials for construction and equipment should be durable and planned to be useful without major remodeling or additions for many years. Availability of equipment service is an important factor in selecting equipment.

h. Location. Consideration should be given to a location that is accessible for deliveries and student groups. It should be possible to use the lunchroom and its facilities without opening the entire school.

58.2 Space Requirements. The space requirements in the school lunch unit require careful planning of the location of specific areas, a compact arrangement of equipment and adequate aisle space.

Section

Space for the dining room should be based on the number of pupils to be seated at one time, but space for the kitchen and related areas is determined on the basis of the total number of meals to be prepared and the type of service. Small operations will require a higher number of square feet per meal to provide space for essential facilities. Specific areas to be considered are:

a. Receiving and Storage. Space should be included for checking deliveries and, where necessary, an outside loading dock. Dry storage should be planned for a two weeks supply of purchased food and six weeks supply of government donated foods. The placement and adequacy of refrigerated storage for the large quantities of milk handled in the school lunch program should be given special attention. See sections 105.331, 105.41, and 105.421–105.422 for further detail.

b. Food Production Areas. The location of kitchen work centers, equipment, and related areas should be carefully analyzed for control of main aisles of traffic and flow of work. Adequate aisle space around equipment should allow for personnel to work, carts to move, and doors to open. Allow a minimum aisle width of 36 inches when one person works alone; 42 inches where more than one person may work or persons must pass each other. For description and recommended space provisions for food preparation areas see section 105.331 and sections 105.441 thru 105.445.

c. Serving Area. Avoid unnecessary space in the serving area. Plan counter length and number of counters consistent with fast, efficient service. Aisle space in front of counters should allow for the orderly passage of a single line of pupils. Refer to sections 105.451 and 105.452 for details of the serving area.

d. Dishwashing and Maintenance. The required space for dishwashing will vary considerably with the type of equipment and dishwashing machine installed. For space and equipment suggestions for dishwashing facilities, refer to sections 105.461 thru 105.466. Refer to section 105.43 for maintenance area recommendations.

e. Dining Area. Assume 85 to 90 percent of the building population will use the dining area with maximum load at peak periods equal to one-half to one-third of the population. Allow 12 sq. ft. of floor area per occupant for 150 occupants or less per peak sitting or period and 10 sq. ft. per occupant above 150.

f. Employee and Office Facilities. Space requirements will vary with the number of employees and the organization of the program in the district. See sections 105.48 and 105.49 for statement of desirable features.

58.3 Special Considerations: Refer to

105.47 Cafetorium (105.471)
105.51 Central kitchens
105.52 Selection and Procurement of School Lunch Equipment
105.53 Equipment Lists and Recommendations
105.54 Adaptations for Handicapped Children
105.55 Emergency Feeding in Civil Defense Programs.

SECTION 59.0 SPECIAL EDUCATION FACILITIES

Section

59.01 GENERAL

a. Minnesota statutes make it mandatory for every school district to provide instruction and services for resident educable handicapped children of school age—every child who is deaf, hard of hearing, blind, partially seeing, crippled, who has defective speech, is mentally retarded (approximate I.Q. range 55–75), emotionally disturbed or a special behavior problem. State aid is paid to districts for maintaining such programs and services.

NOTE: Statutory references: M.S. Sections 120.03; 120.17; 124.32.

b. Minnesota statutes also provide that school districts may establish programs and services for trainable children—children so severely mentally retarded as not to be educable—and to receive state aid. These children have an I.Q. range below an approximate 55 and often have multiple handicaps.

NOTE: Statutory references: M.S. Sections 120.04; 120.18; 124.33.

59.02 Facilities Needed. General Considerations

a. Special education programs for handicapped children are most prevalent at the elementary level. Facilities are generally similar to those needed for normal children, including provision for visual, thermal, and acoustical comfort, space for activities, sufficient appropriate equipment and convenient toilets. However, building adaptations, special location, and in some cases, provision for treatment, are necessary.

b. The number, type and size of special rooms needed will be determined by careful local survey to assess the number and types of handicapped and trainable children, and development by educational planners and consultants of suitable programs for them, including educational specifications for the kind of facilities needed.

c. Special facilities, when provided for certain handicapped and trainable children (not all handicapped children will need special facilities) should be located on the first or ground floor in an area of the building that insures segregation from sources of sound. Facilities should be adjoining a bus driveway. Departments and laboratories serving both exceptional children and normal children should be on the first floor and conveniently accessible. Facilities for serving lunch should be considered, either in a special lunchroom, regular lunchroom, or in some cases in the classroom. Provision for play, physical education and safety must be given consideration.

59.03 American Standards Specifications. The American Standards Association Inc., 10 East 40th Street, New York 16, N.Y. has developed: "American Standards Specifications for Making Buildings and Facilities Accessible to and Usable by, the Physically Handicapped." (ASA 117.1—1961). See Section 137, Fire Marshal's standards.

These specifications include:

"4. Site Development
4.1 Grading
4.2 Walks

Section

4.3 Parking Lots
5. Buildings
5.1 Ramps with Gradients
5.2 Entrances
5.3 Doors and Doorways
5.4 Stairs
5.5 Floors
5.6 Toilet Rooms
5.7 Water Fountains
5.8 Public Telephones
5.9 Elevators
5.10 Controls
5.11 Identification
5.12 Warning Signals
5.13 Hazards"

This 11 page brochure may be obtained from the Department (limited number); or from the American Standards Association at a very nominal price. Schools planners, when considering needed facilities for physically handicapped pupils, should carefully examine these specifications for applicable items.

59.1 THE VISUALLY HANDICAPPED

59.11 General. In the elementary school today, programs for visually handicapped children are of a resource nature, utilizing normal school facilities to the extent possible. The program involves the pupil, a teacher certificated in the special education field, and special instructional materials and equipment.

59.12 Classroom. The usual size classroom will generally provide adequate instructional space and freedom of movement for children engaged in various activities such as typing, use of braille writers, large illuminated magnifiers, etc.

59.13 Listening Rooms. In addition to a classroom, it is desirable to provide small, acoustically treated rooms, connected with the classroom where pupils may listen to tape recorders, talking book records, or radio.

NOTE: Earphones or individual carrels or booths may suffice.

59.14 Equipment

a. EQUIPMENT for the blind should include Braille relief globes and maps, Braille books, large size models, three speed record players, talking book records, tables of different heights for Braille writers, typewriting tables with typewriters, piano, and radio. Additional equipment for the partially sighted include large sight saving globes and maps, easels, books in 18–24 point type, tape or disc recorders, and typewriters with large type.

b. PUPIL DESKS should be movable and have adjustable tops.

59.15 Storage. Ample storage should be provided adjacent to classrooms. Consideration should be given to the height and depth of shelving for storage of Braille books, large type books and other special equipment and materials used.

59.16 Visual Comfort. The rooms should be designed so as to provide a maximum of light of uniform intensity and low brightness contrasts. Special attention should be given to color schemes, surface finishes, and artificial lighting. Artificial light should provide 80–100 footcandles of light throughout the room. Daylight should be controlled so as to exclude the direct rays of the sun or reflected brightness of high intensity. Bulletin boards and chalkboards should be well lighted; display material at eye level.

59.2 Children with Hearing Defects

59.21 General. Hard of hearing pupils will use facilities provided for the instruction of normal pupils. However, such pupils require, in addition, a specialized educational program, the services of a specially trained teacher, and a room that is properly equipped for their instruction. In addition to lip reading, they usually need speech therapy and should have auditory training which will enable them to use a maximum of residual hearing.

59.22 Location. This room should be located in a quiet section of the building, removed from sources of vibration from machinery, heating systems, etc.

NOTE: The low frequency noise of univents is undesirable.

59.23 Size. Space equal to that of a regular classroom is desirable for a class of about 8 to 10 pupils. There should be provision for workcounters, cabinets, record storage, shelving, files, and tables.

59.24 Screening Area. If not provided in the Health Unit, a small room, about 150 square feet in area, is desirable for audiometric screening. This room should be adjacent to the classroom, connected with it and also to the corridor.

59.25 Acoustical Treatment. Classroom and screening area should be acoustically treated for noise reduction and to reduce sound reverberations to a minimum.

59.26 Visual Comfort. All surfaces should have non-glare finishes. Special sight saving illumination should be provided to relieve the strain and fatigue of pupils using eyes excessively in learning to lip read.

59.27 Equipment:

a. Each room should be provided with a large mirror for speech training use, chart holders, adequate bulletin and chalkboards, electrical outlets for a variety of audio and visual aids, and sufficient storage space for equipment.

b. Each room should be equipped with a powerful group hearing aid, with microphone, radio, and record player contained within the unit. There should be individual jacks for pupils' earphones or hearing aids so that each pupil station may be connected with sound amplifications.

59.28 Enclosed Play Space. As a safety measure, play space for children with impaired hearing, especially if near streets, should be enclosed.

59.3 Speech Correction Rooms

59.31 General

a. Speech correction is a matter of individual or small group instruction of a remedial nature. Such children use the same facilities and are offered the same program provided normal children, but they need the special help of a speech therapist provided in a special facility.

b. In planning school buildings, provision should be made for one or two rooms of this type, according to the size and needs of the school.

59.32 Location. The speech correction room should be located in a quiet area of the building. For crippled children with speech defects it should be readily accessible from the occupational or physical therapy room.

59.33 Size. This room should be about 400 square feet in area, preferably larger. It should be large enough to accommodate chairs, tables, and desks of various sizes, and cots for relaxation if crippled children. Sufficient floor space should be arranged and outlets provided for use of hearing aids, radio, and record player. There should be ample storage space for audio and visual equipment, sense training materials, games, books and records. Where the speech correctionist is itinerant, locked storage should be provided for special equipment.

59.34 Acoustics. This room should be acoustically treated and away from the street, playground, and rooms from which voices are emitted.

59.35 Lighting. Be well lighted to 100–150 foot candles.

59.36 Office. A speech correctionist's office is essential. This ideally should be a separate room adjacent to the speech correction room, although space may be provided within the working area. Under these circumstances, a partial partition should separate the office from the correction area so that it affords privacy for interviewing and counseling parents. The office should be equipped with table, chairs, filing case and shelving. About 60 sq. ft. of floor area is required for the office space.

59.37 Other. Be equipped with mirrors, chalkboard, tackboard, special equipment, and materials.

59.38 Combined Speech Correction and Remedial Reading Rooms. See Section 54.

59.4 Facilities for Crippled Children—Orthopedic Unit or Adaptation

59.41 General

a. Crippling conditions result from many causes and affect children in many ways. A primary concern for pupils requiring orthopedic care while in school is providing facilities and treatment, which may include physical, occupational, and speech therapy. Other children may require special building adaptation rather than treatment.

b. Instructional facilities usually recommended for the convenience and instruction of normal children should be provided for orthopedic cases.

59.42 Location and Special Building Adaptations

a. Facilities for crippled should be LOCATED on the first floor close to an entrance door, to the lunchroom and other general use rooms. A sheltered bus loading platform should be provided so that children can be wheeled directly into school.

b. ENTRANCES and CORRIDORS should have handrails for those who can use them. THRESHOLDS should be omitted; all DOORS should be 6 inches wider than customary to admit wheel chairs; Door opening for 90° swing should be 36″ minimum, and for 180° swing, should be 32″ minimum; FLOORS should have non-slippery surfaces.

Section

c. RAMPS should be used for minor changes in floor levels. In multistoried buildings, elevators must be provided if all of the orthopedic unit or instructional facilities are not on one floor.

NOTE: For recommended detail, see Section 59.03 "American Standards Specifications."

59.43 Classrooms. Orthopedic classes may be smaller than the average size classroom group, but classrooms should be of normal size or larger, since the classroom must accommodate pupils in wheel chairs, in stand-up tables, or on crutches, and permit flexible arrangement of activity and instructional areas for various age groups. Types of classrooms required will be determined by the range of grades to be housed. Acoustical treatment, darkening shades, and outlets for use of audio-visual equipment are essential.

59.44 Toilets. Space should be provided for separate toilet rooms for boys and girls adjacent to the classroom. Toilets should be ample in size to accommodate circulation of wheel chairs. The necessary toilet fixtures should be equipped with handrails at lavatories and handrails and grab bars suspended from the ceiling at water closets. Water closets should be equipped with right and left hand flushing devices. See Section 59.03.

NOTE: In some schools, one lavatory and one water closet so equipped may suffice. Refer to "American Standard Specifications."

59.45 Rest Facilities. Facilities should include a rest room with sufficient space for cots and for the storage of linen and blankets. Most orthopedic and all cardiac children require these facilities.

NOTE: Some teachers prefer a limited number of facilities for rest within the classroom when needed rather than a separate room for mass resting. Sun deck chairs can often be substituted for cots for this purpose.

59.46 Facilities for Physical and Occupational Therapy. If facilities for therapeutic treatment are desired, confer with the Department of Education consultant on education and therapy for crippled children, Special Education Section. Such facilities, if they are included, should consist of:

a. CORRECTIVE GYMNASIUM of ordinary classroom size, with provision for storage of corrective equipment;

b. TREATMENT ROOM of large classroom size for heat, light, and muscle-coordination treatments, arranged with flexible booths, separated by curtains, and with cupboard space in easy reach for storage of linens, sand bags, and miscellaneous equipment; storage space for extra crutches and braces; electrical outlets installed for heat and light treatments, whirlpool bath, dryer, and hot-pack machines.

c. PHYSIOTHERAPIST'S OFFICE or suite is essential. It should be equipped with an individual desk for each therapist, filing case for records, and book shelves. Opening off this room or suite should be a room or rooms for clothing lockers, dressing space, showers, lavatory and water closet. Provide facilities for room darkening and projection of posture pictures and films.

Section

d. A SWIMMING POOL is desirable, either in the building or within easy access; hoist provided for lifting pupils in and out of pool; pool room acoustically treated. Auxiliary facilities should include shower room and stalls, dressing compartments, hand flushed toilets, lockers for street clothing, provision for towel exchange, and storage.

f. HEAT CONTROLS arranged to permit a temperature of 85 degrees F. in the swimming pool and up to 95 degrees in treatment room and tanks.

59.5 FACILITIES FOR CARDIACS

a. Some children may need treatment provided in the orthopedic unit or may be assigned to this unit when transportation is available.

b. For others, classes will be on the first floor in regular sized classrooms.

c. All accommodations must be available without climbing stairs.

d. A room equipped with cots, darkening shades, and storage should be provided, or such facilities provided in the classroom, so that heart pupils may rest upon arrival and as prescribed by their physician.

59.6 FACILITIES FOR MENTALLY RETARDED CHILDREN

59.61 Educable Mentally Retarded. (Slow learners with I.Q.'s approximately 50–75).

NOTE: Mandatory instruction, M.S. 120.17. State Aid: M.S. 124.32.

59.611 General

a. Such boys and girls are much like normal children in their physical development. Classes for these children should be located in the building where there are grades that serve children of the same age.

b. Such children should have privileges of recreation periods, assemblies, work in art, music, library, craftwork, physical education, excursions, and audio-visual aids that are provided for other children.

c. Class enrollment should approximate one-half of an average size class. Instruction is centered around "life situation units" aimed at training these children to become well adjusted, self-respecting, cooperative family and community members. Emphasis is placed on developing capacities for emotional stability, good social behavior, and self-support.

59.612 Classroom

a. At the elementary level, a complete, regular sized classroom should be provided, largely self-contained, with space for work counters, work benches, cabinets, shelving, and filing space. Space should be provided for an aquarium, plant boxes, easels, play tables, sand tables, and a piano. Storage space is needed for books, toys, musical instruments, and hand tools. Equipment and storage will be adapted to age group of pupils, or varied age of pupils. Work area may be separated from class instruction area by a glass partition.

b. There should be provision for arts and crafts and phases of homemaking.

c. There should be separate toilets for boys and girls, adjacent and connected with the classroom.

Section

59.62 Trainable Mentally Retarded (Severely mentally retarded with I.Q.'s below an approximate 55).

NOTE: Permissive instruction. M.S. 120.18 State Aid. M.S. 124.33.

59.621 General

a. With the passing of permissive legislation by the state legislature in 1957 and a bill providing for state aid payments for approved programs, there has been a trend among school districts to develop programs for the extremely mentally retarded children (trainable but not educable) who were formerly excluded from school.

b. Training emphasis is usually on the development of various aspects of self-help, i.e., living together, communication, locomotion, safety, good personal and social habits, with exploration of primary relationships found in the family, school, and neighborhood. Such pupils may be expected to make only a partial adjustment to the community, and will remain wholly or partially dependent on parents and society for their total life span.

59.622 Classroom considerations.

a. Experience indicates a class size of about 8 children.

b. A semi-isolated self-contained classroom close to an exit in a regular elementary building is recommended with toilet facilities adjacent and connected with classroom.

NOTE: Some school planners prefer to locate the facility for the severely mentally retarded (trainable) children separate from the regular elementary school building.

c. Furniture will be adapted to the various sizes of the pupils and equipment to the varied abilities, interests, and needs of the pupils whose mental ages will probably range from 4 to 7½. For older children, facilities for training children in simple household tasks should be provided.

d. A kitchenette is desirable, since lunch served in the classroom permits training in eating habits.

e. There should be provision for arts and crafts.

f. Equipment needs will be related to the special education program and not to normal grade levels. Equipment may include blocks, toys, games, picture books, simple arts and crafts materials, work benches, tools, record players, projectors, screen, television, sense training materials, etc.

g. Adequate storage should be provided for the equipment needed which may range from that required at the nursery level, the kindergarten level, the first grade level, and possibly the second grade level for older pupils with I.Q.'s approaching 50.

59.7 FACILITIES FOR EMOTIONALLY DISTURBED

59.71 General. At the present time, planning for the rehabilitation of the emotionally disturbed is at an experimental state. Experience to date indicates the number of children per teacher should be small, possibly 8–10 children.

59.72 Classroom. A classroom of regular size should be provided, largely self-contained, on the ground floor, and as isolated from the other classrooms as possible.

59.73 Equipment. The classroom should contain eight or ten movable desks, work counter and sink, storage below counter, a work table, ample cupboard space, space, chalkboard and tackboard. A fountain and toilets should be provided in or adjacent to the classroom. An alcove or offset from the classroom should provide rest facilities, such as a cot, with some degree of isolation.

59.8 PSYCHOLOGIST'S EXAMINING AND CONSULTING ROOM

59.81 General. A new school building may incorporate at least one small room for the use of such personnel. The room should be adaptable both for individual conferences and to counseling with small groups of 5 or 6 pupils evidencing similar problems. For many schools, a room in the health suite will suffice.

59.82 Location. The room should be on the ground floor, out of main traffic areas, easily accessible to handicapped children, parents and others.

59.83 Equipment. Provide at least one work table and several chairs. A combination storage and wardrobe area should be provided.

59.84 Additional Features. Room should be acoustically treated, as sound proof as possible; lighting at optimum levels; ventilation as near ideal as possible; room colors pleasant, but offering a minimum of distraction. In large schools, provision may be made for several of these rooms to have one way observation windows for training and consultation purposes.

59.9 OTHER CONSIDERATIONS, SPECIAL CLASSROOMS

59.91 Design. Classroom layout and design for those children who do not have access to similar facilities in the school should consider (1) a library corner, (2) a science center with aquarium and terrarium, (3) an art center with easels, clay area, and finger painting tables, and (4) a news center with bulletin boards where events of interest can be recorded daily.

59.92 Color. All finish, trip, walls, furniture and equipment should be light in color and have high reflective values, with non-glare finishes.

59.93 Floors and Ramps

a. FLOORS. All floors should be surfaced with non-slip materials to reduce slipping and falling to a minimum. See 59.03.

b. RAMPS. Ramps wide enough to permit the passing of two wheel chairs should be used in all schools instead of steps. A slope with a ratio not exceeding 1 to 12 is recommended and a non-slip surface is to be provided. See 59.03.

59.94 Heating and Ventilating. See Sections 230–259.

59.95 Plumbing

a. Individual toilets adjacent and opening off the classroom should be provided for crippled, mentally retarded and emotionally disturbed children, and are recommended for visually handicapped children. See 59.03.

b. Work sinks, preferably built into counters should be provided in each classroom.

Section

c. Hot and cold water supply should be provided in each classroom at lavatories and worksinks.

d. Drinking fountains should be provided in each classroom, preferably separate from worksinks. See 59.03.

59.96 Electrical

a. At least three receptacles should be provided in each room used for instruction or testing, one at the front, rear, and side wall. A receptacle should be provided over each work counter location, not less than 5 feet from the sink.

b. Outlets or jacks should be provided in the classroom for the hard of hearing so that each pupil station may be connected by means of a hearing aid with sound amplification controlled by the teacher or the pupil.

c. Special lighting should be provided at the chalkboards and bulletin boards in the classroom for the children with partial vision, the hard of hearing, and the mentally retarded.

Section

d. Electric lighting should be designed and installed to provide the following average, maintained in service intensities on desks, chalkboards, tackboards, and display boards:

(1) Sight saving classrooms	150 footcandles
(2) Hard of hearing classrooms	100-150 footcandles
(3) Remedial reading and speech correction classrooms	100-150 footcandles
(4) Classrooms for educable and trainable mentally retarded	70 footcandles

59.97 Acoustics. Proper acoustical treatment should be provided in each room. See Sections 176-177.

59.98. Audio-Visual. Provide darkening facilities for all special education classrooms. See Section 196.

60-69 Reserved for future use.

SECTIONS 70-99. SECONDARY SCHOOL INSTRUCTIONAL AREAS

Section

70.0 SECONDARY SCHOOL FACILITIES

70.1 General. School people planning educational programs and their supporting building facilities for secondary school youth must give consideration to the broad and varied needs of youth, who following graduation from high school will become job holders, homemakers, college students, members of the armed service, community citizens—widely dispersed, for the most part, in towns and cities throughout the state and nation. Every secondary school, therefore, should incorporate means of meeting these needs and be reasonably complete and comprehensive in its planned educational program and services.

70.12 Size of Secondary Schools. A desirable minimum enrollment for a secondary school, grades 7–12, is considered in Minnesota to be about 450 pupils for 3 sections of about 25 pupils per grade. There is little agreement on the optimum or the maximum size of secondary schools. In Minnesota, especially the Metropolitan areas, dense population, good transportation facilities, broad educational offerings, specialized facilities, and the need for economy seem to warrant the construction of junior secondary schools housing about 1500 pupils and senior high schools housing from 2200–2400 pupils.

70.2 Characteristic Areas of the Comprehensive School. The comprehensive secondary school may include all or most of the following centers or areas:

a. **Administrative-student personnel center:** Administration, guidance, and health areas.

b. **Student activity center:** student center and school lunch.

c. **Instructional materials center:** library, audio-visual, and materials production areas.

d. **Language-social studies center:** English, social studies, foreign language, language laboratory areas.

e. **Mathematics and science center:** mathematics classrooms, math laboratory, science classroom-laboratories.

f. **Arts center:** arts and crafts, music, dramatics areas (multi-use auditorium).

g. **Industrial arts area:** classroom(s), laboratory-shops.

h. **Homemaking area:** home economics, classroom-laboratories.

i. **Business education area:** business and office education facilities.

j. **Distributive Education:** facilities for students and coordinator-teacher.

k. **Agriculture education area:** classrooms, laboratory, shop areas.

l. **Physical and health education center:** gymnasium, outdoor physical education, and health classroom(s) areas.

m. **Driver education area:** training center and outdoor driving range.

n. **Special education areas:** as needed for physically and mentally handicapped.

Section

o. **Parent and adult education area:** multi-use of several areas.

Note: **Vocational trade and industrial education areas:** These will be located in classified area vocational-technical schools.

70.3 Instructional Facilities, General. Instructional facilities and their building implications are described in the following sections. For other sections having application to secondary school buildings, see the following:

Section	Section Title
1– 39	Procedures in School Plant Planning
40– 49	The School Site
100	Administrative Unit
101	Guidance Facilities
102	Health Center
103	Teachers Rooms
104	Student Activity Rooms and Centers
105	School Lunch Unit
106	Auditoriums and Stages
110–119	Service Facilities
120–149	Fire and Life Safety
150–169	Structural Design
170–189	Sound Control
190–209	Lighting and Fenestration
210–229	Plumbing Design, Sanitary Fixtures and Trim
230–259	Heating and Ventilation
260–279	Electrical Design
280–289	Preparation of Plans and Specifications

70.4 Some Trends Affecting Facility Planning

a. **Use of new instructional media.** These may include: electronic laboratories, open and closed circuit television, teaching machines, video tape, overhead and to-the-rear projection, radio, disc and tape recordings, and many other kinds of equipment available to supplement the instructional process.

b. **Variable size groupings.** Experimental programs have indicated that much background or overview information in a unit of subject matter can be presented by a talented teacher in a large group situation (100 or more pupils). More personalized teacher-pupil instruction and discussions can be conducted in a medium group situation such as an average classroom (25–30 pupils). Instruction tailored to small groups or individuals can be handled in small seminar groups (5–15 pupils) or by individual study.

c. **Variable length class periods.** Flexible scheduling, based on some shorter and some longer units of time than the traditionally uniform length class period is being developed, particularly in the junior secondary years, grades 7–9, to cope with problems of increasing the range of subject area exploration, individual differences among pupils, and the need for greater continuity in the study of some subject areas.

70.5 Flexibility of planning. If the educational program to be housed involves the use of new instructional media and varied groupings, the following building implications are warranted:

a. The total school plant should be flexible. There should be no load bearing partition walls. It should be possible to rearrange areas to facilitate the refinement of existing programs and the development of new programs (applicable to all buildings).

b. There should be areas of various sizes to accommodate instruction suited to large and small groups of pupils as well as to the medium sized groups on which, traditionally, emphasis has been placed.

c. Spaces—at least some spaces—should be provided with movable acoustical dividers which will allow change to varying sizes throughout the school day or week.

d. There should be electrical facilities and light control for the effective use of a wide variety of communications media: audio-visual equipment, teaching machines, and other instructional material and equipment.*

e. Pupils should be provided with some individual work spaces which will foster independent study and research.

70.6 NUMBER OF CLASSROOMS FOR INSTRUCTION. The following procedure is generally adequate to determine the number of general classrooms (teaching stations) for instruction:

a. Divide enrollments in each of the subjects by desirable class size.

b. Divide the sum of these quotients by number of periods, less one, in the daily schedule. Quotient will be the number of general classroom teaching stations needed.

c. The number of remainders from item b. represents the number of pupils in excess. These may be handled as small classes, as full classes, or distributed in the sections above, depending upon their size.

70.7 NUMBER OF CLASSROOMS FOR STUDY

a. Proper design will account for every pupil in a suitable pupil station every period he is in school, including study periods. The extra period in the daily schedule (not used in 70.6 b. above) will be a study period in most general classrooms.

b. Additional space may be needed for study sections. This shortage may be met by providing general classrooms to the extent needed, using 30 pupils per study section and occupancy all periods in the daily schedule, or providing special rooms for study.

70.8 SPECIAL ROOMS FOR STUDY. Some double classrooms with movable acoustical dividers, or a larger study hall or multipurpose room may be considered as well as general classrooms for study purposes. A study hall used for full time study should have direct access to the library.

---

*Applicable to all buildings.

SECTION 71.0 GENERAL CLASSROOMS

Section

71.1 **Program.** General classrooms are those teaching stations used for general classroom instruction as distinguished from other instruction necessitating special facilities, such as shops and laboratories. They are used primarily for English (language arts), social studies, and mathematics. They may be used for the classroom teaching phase of modern foreign language.

71.2 **Size.** General classrooms may be designed for any size class, but generally fall into three types:

a. **General classrooms,** for classes of 25–30 pupils. Twenty-five pupils is considered a desirable sized group for most classwork.

b. **Small classrooms,** for 15 pupils or less, where variable sized groups are organized for instruction, or for small elective classes.

c. **Large classrooms,** for any large group to be accomodated.

71.3 **Floor area.**

a. A general classroom in which one teacher will guide the instructional processes in what is, for the most part, a self-contained classroom, will require gross floor area of from 840 to 900 or more square feet. This space will provide a pupil activity area for about 30 pupils; a teacher's resource center (desk, wardrobe, storage, files, book and magazine shelving, projector, television, other mechanical teaching devices); reference shelving; tackboard and chalkboard suited to the subject area taught; audio-visual screen; and a small conference room with a vision window. Window glass is limited. Artificial light is controlled by a dimmer, permitting projection and note-taking at the same time.

Note: For suggested floor plan for a classroom of the above type write or contact the School Building Planning Section of the Department of Education.

b. Smaller classrooms, if needed or desired, should have gross floor area of at least 400 to 420 square feet. A general classroom of 840 square feet, for example may be divided by a folding partition or other acoustical dividers into two small classrooms, each 420 square feet. An entrance and exit would be provided for each small classroom.

c. A larger classroom, if desired, may be obtained by combining two classroom areas, separated for flexibility, by a movable acoustical divider.

71.4 **Auxiliary Spaces.** A small **conference room** may be provided in a corner section of the classroom, with observation window, and with access from the classroom, and if desired, from the corridor. Or a conference room may be located between two classrooms and accessible from each. This conference room may be divided into: (1) a preparation and work room with observation windows and (2) an office and conference area. The office and conference area has access from the workroom and corridor and may be used by a third teacher for conferences. Storage is provided between the two spaces.

Section

Office and work center. In schools with sufficient staff and enrollment to warrant organization of subject areas in departments, an office and work center is often provided for closely related subject areas, i.e., language arts-social studies; math-science; arts and crafts-music. Example:

Language Arts-Social Studies Office and Work Center	Square Feet
Interdepartmental work	250–300
Reading laboratory	200–250
*Individual pupil study-work space 15–20 at 20 sq. ft.	300–400
Departmental office area at 50 sq. ft. per teacher	
English—10 teachers	500
Social studies (6)	300
Foreign language (3)	150

---

*When local program provides for individual study.

71.5 **Location.** General classrooms should be in a semi-quiet area convenient to central library and audio-visual and instructional materials center.

71.6 **Equipment.**

a. **Chalkboard.** Not less than 20 lineal feet 42" high with at least 16 lineal feet on the front wall. Mathematics rooms: chalkboards on the side wall as well as on the front and back; less tackboard. For mathematics rooms, grades 7–10, from 36 to 44 lineal feet of chalkboard; less for classrooms used for advanced mathematics: higher algebra, solid geometry, trigonometry; in grades 11–12, —20 lineal feet may be sufficient. Foreign language classrooms: 28–36 lineal feet.

Note: Movable chalkboards and tackboards limited to 4 foot sections may not prove functional.

b. **Tackboard.** Not less than 16 lineal feet 42". Classrooms used primarily for instruction in English and social studies should be provided with about 24 lineal feet.

c. **Display.** Combination map rail and tack strip at the top rail of chalkboards and tackboards. Tackboard strips, if used, should be at least 12 inches high to accommodate 8½" x 11" paper.

d. **Bookcases.** Open shelf type bookcase or bookcase with glazed door with at least 16 feet of adjustable shelving.

e. **Teacher's wardrobe.** A ventilated closet with door and lock should be provided in each room for teaching materials and coats. The closet should be about 4 feet wide by 2 feet deep with pole for hanging garments, with shelf above on one side, and five or six adjustable shelves for teaching materials and supplies on the other. If teachers' lockers are provided elsewhere, omit wardrobe section.

Note: Some teachers prefer less shelving and more letter size file space.

f. **Storage.** Each classroom should be provided with sufficient and suitable storage for instructional materials, resource materials, pupil projects, and audio-visual aids. Needs for storage will vary with the over-all system of storage and distribution, particularly for audio-visual supplies and equipment. When a room is used for instruction in more than one subject, separate storage facilities (consider portable storage units) should be provided. In rooms used pri-

GENERAL CLASSROOMS

Section

marily for history and social studies, provision should be made for storage of maps, charts, globes, models and other special materials. In rooms used primarily for mathematics, provision should be made for storage and display of models, instruments, and visual aids.

g. SMALL STAGE. One of every three classrooms used primarily for English should be equipped with a small stage or platform. In every school at least one room should be equipped with a stage.

h. ELECTRICAL. With the amount and variety of equipment now in use, outlets should be provided on all sides of the room. At least one double outlet per wall is desirable, installed about 18" from the floor to avoid dirt and floor wax but not so high as to invite tampering by pupils. All outlets should be grounded type. Conduits should be oversize to permit alterations and additions to wiring; raceways should be accessible. Conduits for closed circuit TV should be installed. Clocks and speakers should not be centered above chalkboards on the front wall but be off-center or on a side wall.

i. PUPIL LOCKERS. Metal lockers, one for each pupil enrolled, recessed in the corridor wall, height 5′ junior high and 6′ senior high school, equipped for suitable padlocks are recommended for clothing storage.

71.7 LIGHT CONTROL. Provide means of natural light control by venetian blinds, opaque drapes, or shades. For electric light control, a light switch or dimmer in the position most convenient to the operator of projection equipment. See Sections 194.8 and 196.2.

71.8 SOUND CONTROL. With the increasing use of projectors, recording and playback equipment, closed circuit TV, radio and intercommunications systems, the acoustical requirements of classrooms must be carefully considered. Consult Sections 170–189. In general, the most efficient use of acoustic tile is around the perimeter of the room only—on ceiling or wall. The smooth hard center of the ceiling is used to reflect maximum sound to the rear of the room. Installation of sound panels or any structural modification should be attempted only on the advice of an acoustical engineer.

71.9 PLUMBING. Where laboratory type preparation and work areas are desired, provide work counter and sink with hot and cold water.

SECTIONS 72-73. THE INSTRUCTIONAL MATERIALS CENTER

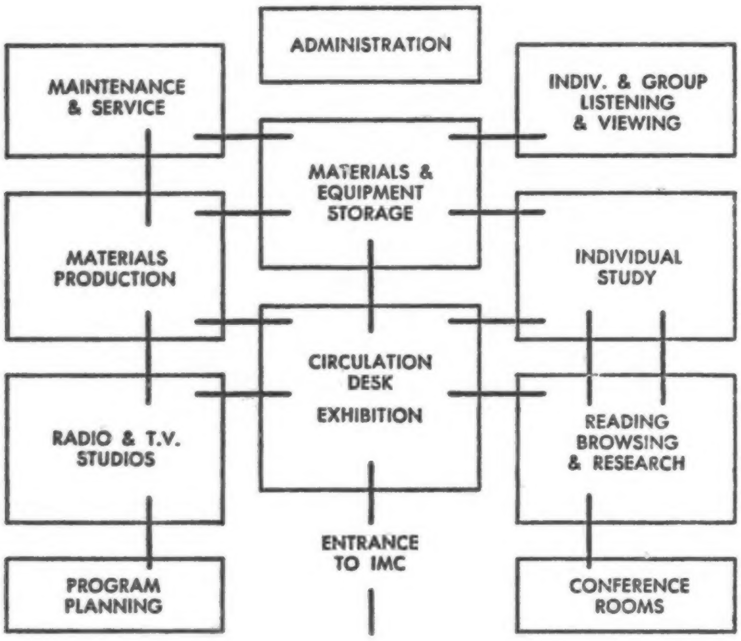
Section

72.00 GENERAL. In order to make full and effective use of all known media of instruction and new media as developed, it is recommended that an INSTRUCTIONAL MATERIALS CENTER or CENTERS (Library and Audio-Visual Education) be provided in every secondary building.

72.01 ADMINISTRATION. There are currently two concepts for the development of instructional materials and services.

a. In the FIRST concept, a media specialist serves as administrator of an Instructional Materials Center, directing the services of various resource, production, and distribution personnel for the most effective service to pupils and teachers.

(1) The following diagram shows some of the general space relationships in the integrated INSTRUCTIONAL MATERIALS CENTER.



(2) The broad functions of the Instructional Materials Center are:

(a) To unify all functions relating to instructional materials and equipment for the most efficient and economical service to teachers and pupils.

(b) To select, purchase, distribute, maintain, and house an abundance of instructional materials and equipment: books, periodicals, pamphlets, pictures, models, mock-ups, dioramas, slides, films, records, tapes, maps, charts, screens, T.V. and radio receivers, recorders, teaching machines, and other new media as developed.

(c) To assist the teacher to produce and improve teaching aids so as to make learning more effective for all pupils.

(d) To use instructional media as aids in developing the capabilities of the individual, using the eye, ear, and other sensory stimuli, in such areas as: talk-listen, write-read, show-look, make-use, handle-store, etc.

Section

(e) To provide a logical area around which to organize certain learning activities:
- Reading and browsing
- Individual research and study
- Small group conferences
- Listening and viewing, utilizing a variety of media.

b. In the SECOND concept, the purposes and goals are the same, but there is administration and operation of the library areas by the librarian and library personnel, and of the Audio-Visual Education areas by the A.V. Education director and A.V. Education personnel. There are, in practice, two major centers: (1) Library and (2) Audio-Visual Education. Major facilities are:

(1) LIBRARY CENTER
- Entry (circulation area)
- General reading
- Periodicals
- Stacks (large schools)
- Research
- Individual work-study
- Listening
- Conference
- Office
- Workroom and storage
- Textbook storage (optional)
- Receiving.

(2) AUDIO-VISUAL EDUCATION CENTER
- Distribution area
- Equipment storage
- Materials storage
- Inspection and repair
- Office
- Planning and producing area
- Dark room
- Photographic area
- Reproducing: reflex copy ditto mimeo, etc.

ORIENTATION AND COORDINATION. The Library Center and the Audio-Visual Education Center are adjacent or near each other. The effective coordination of the library functions and the audio-visual education functions is attained through the secondary school principal, superintendent, or other administrator.

72.02 OTHER DESIRABLE FEATURES. Provide:

(1) Central location for efficient distribution of equipment and materials and for convenient use by teachers and pupils.

(2) Elevators or ramps in buildings of more than one floor.

(3) Floor and entry ways through which carts must pass free of obstructions; kickplates and jamb protection where equipment must be moved through doors.

(4) A ground floor location (preferably) due to weight of materials and equipment in the Center and the problem of handling supplies and equipment.

(5) Storage, cabinets, shelves, and walls (where acoustical considerations permit) designed to be movable so space may be rearranged to meet changing functions of the Center and make possible multiple use of space.

(6) Isolation of noise producing areas from reading rooms and individual work-study and research areas. Activities that generate noise are previewing, testing and repairing

equipment, auditioning, preparing teaching aids and equipment, and distributing equipment.

(7) Planning of the Center so that it can be expanded with a minimum of cost and disruption of adjoining areas.

(8) Adequate storage. This will depend on the degree to which this function is shared between the Center and the classrooms. Give due consideration to long range requirements for storage of equipment and materials.

72.03 Planning Facilities. Local philosophy as to the development of instructional materials services will determine the concept of administration adopted and the planning of desired facilities.

a. In the Sections which follow, recommended standards are stated to assist school planners in designing facilities and providing adequate space for functional instructional materials services.

b. For those wishing a more detailed description and discussion of the "Instructional Materials Center," see "Planning Schools for New Media—A Guide for Boards of Education, School Administrators, and Architects." 1961. Amo De Bernardis and Others (Cooperative project with the U.S. Office of Education). Copies are available for $1.00 per copy (to cover cost of handling and mailing) from the Division of Education, Portland State College, Portland, Oregon.

72.0 THE LIBRARY CENTER

Note: Serving a secondary school or combined school, grades k, 1–12.

72.1 FUNCTIONS

72.11 General. The library is an essential learning laboratory for all levels of education in the school program, and the materials center for housing and making readily available many kinds of printed and audio-visual teaching materials. It is the source of mobile collections of books and other materials for classrooms. The library serves the teacher and pupils by helping them in the selection of materials suited to the kinds of educational activities in which pupils are engaged, and by providing guidance in their use. It offers many opportunities for a variety of cultural and social experiences that enrich the lives of pupils. The library program provides instruction in the use of books and libraries and contributes directly to the development of independent study skills.

72.12 Planning Principles

Functional library quarters should be designed to provide for the following:

a. The use of the library reading room by one or more class groups, or by individuals; the use of smaller rooms by pupils working together in groups; and by teachers doing professional reading or working on curriculum projects.

b. The organization, housing, circulation, use, storage, display of a collection of books, audio-visual materials, and related instructional resources for pupils and teachers.

c. The processing and cataloging of printed and audio-visual materials.

Note: In some schools the processing, repair, and storage of audio-visual machines and equipment is also the responsibility of the librarian.

72.2 Planning Library Quarters. The basic library quarters needed to provide for the above functions and activities include a reading room, a work-storage room, and one conference room which may also serve as a listening room. In larger schools, or in those schools wanting more than the minimum facilities, these basic spaces should be supplemented by another conference room, a periodical storage room, preview and listening room, a professional library and teachers work area, and a librarian's office.

a. The reading room should be centrally located and accessible to all pupils and should provide seating for one or more normal size class groups, as well as 15–20 additional seats for individual users. See also 72.3.

b. The conference room or rooms should provide space for small groups of pupils working together with books and audio-visual materials. See also 72.6.

c. The work storage area can be combined in the smallest schools, but the increasing growth of libraries as a materials center demands more than the minimum amount of storage space. See also 72.4 and 72.5.

d. Preview and listening rooms, librarian's office, professional library. See 72.7, 72.8, and 72.9.

72.21 Location. Library quarters should be located:

a. Near the center of the academic classroom area.

b. Away from noisy areas of the building or playgrounds.

c. Adjacent (preferably) or near the Audio-Visual Education areas.

d. For economical future expansion.

72.22 Arrangement for Administration. All rooms in the library quarters should be adjacent and arranged for easy inter-communication with the reading room. The reading room should have only one entrance for general use, unless the fire regulations require a second one.

72.3 Reading Rooms. In addition to the purposes listed above, this area may also be used for viewing TV or for large listening groups.

72.31. Arrangement

a. The CHARGING DESK should be located generally in the area between the entrance and the work room.

b. All available WALL SPACE should be used for shelving. With the possible exception of large schools, in which more than one librarian is employed, shelving sections or stacks which project into the room are not recommended since they use floor space needed for seating and tend to hamper supervision. Shelving under windows is best used for picture books or magazines. Light switches, electrical outlets, thermostats, telephones, and fire extinguishers should not be located in such a way that they use wall space needed for shelving.

c. TABLES may be rectangular (3 by 5 feet), round or square, (4 feet in diameter), or individual, (28" by 39"). Four chairs per table should be provided, with spacing of tables as follows:

5 feet between tables with or without chairs.
5 feet from tables to face of shelving.

Section

d. Width. In a school with more than 500 pupils the reading room should be wider than a classroom (28–30 feet); its length should be proportionate to its width to insure good balance and easy supervision.

e. Furniture and equipment that is uniform in finish and design, including fixed shelves and movable fixtures greatly enhances the library's appearance and has practical maintenance values. Provision may be made for an informal reading area by the purchase and arrangement of informal furniture.

f. Expansion of the reading room. Consideration should be given to the need for future expansion. This is especially important in growing cities and suburban communities. Planning the space should center around the requirements to be met for providing good library service; to care for the estimated ultimate pupil enrollment and faculty using the library at one time; and the amount of shelving needed to house the potential book and materials collection.

g. Window Areas. Wall space needed for book shelving should not be sacrificed to large window areas. It is recommended that a sufficient portion of the window wall be used to help provide the space needed for standard height shelving (6 feet for junior high school and 7 feet for senior high school.

h. Floor. The floor should be covered with resilient, noise-reducing material, such as carpeting, rubber or vinyl

Section

tile. Asphalt tile is not desirable. The reading room area should not have a sunken floor since this limits some of the library's functions, including the provision of services requiring the use of a book truck to take books and materials to classrooms.

i. Large Reading Rooms. If the enrollment is such as to require seating for 100 pupils or more, two separate reading rooms or areas should be provided—a general reading area and a reference research area.

j. Electrical Outlets. Provide at least two electrical outlets on each wall for the use of various kinds of audio-visual equipment, including audio trucks. Locate outlets preferably in the base of shelving units for easy accessibility.

Note: Suggested layouts for the secondary school library may be obtained from the Minnesota State Department of Education, School Plant Planning Section or School Library Unit.

72.32 Standards for Reading Room Seating, Floor Area, Book Collection, Shelving and Circulation.

Figures for seating capacity, minimum gross floor area, book volume capacity, and book shelving are shown in Table 1. for secondary schools with enrollments from 600 to 1800 pupils and for a combination elementary-secondary school with up to 500 pupils enrolled, grades k, 1–12.

TABLE 1. STANDARDS FOR SECONDARY SCHOOL LIBRARY READING ROOMS

	ENROLLMENT			
	Secondary Schools			Grades k, 1–12
ITEMS	600	1200	1800	Up to 500
SEATING CAPACITY—Seat 10% of enrollment when over 500 pupils	60	120	180*	65–70**
FLOOR AREA—Allow 30 sq. ft. per pupil when enrollment exceeds 500 pupils.	1800	3600	5400	1950–2100
BOOK COLLECTION—At least 10 titles per pupil enrolled. Total titles	8000#	12000	18000	8000#
Standard size books (about 95%)	7600	11400	17100	6600##
Oversize books (about 5%)	400	600	900	400
Picture books (about ¼ to ⅓ of basic elem. book collection)	—	—	—	1000
SHELVING REQUIREMENTS—lineal feet				
Standard Shelving for standard size books @ 10 books per lin. ft.	760	1140	1710	660
8″ deep shelves;				
6′ high for jr. h.s.; 7′ for sr. h.s.;				
39″–42″ high for double face counter shelving;				
3′ wide sections.				
Oversize Shelving @ 6 books per lineal foot	66	100	150	66
10″–12″ deep shelves, otherwise the same as standard shelving.				
Picture Book Shelving @ 20 books per lineal foot	—	—	—	50
10″–12″ deep shelves; 14″ between shelves;				
Maximum height: 2 shelves 3′ wide sections; dividers every 6 inches	75	100	125	75
MAGAZINE COLLECTION—Min. number of titles	75	100	125	75
Magazine Shelving: lineal feet	60	75	90	60
10″–12″ shelves;				
3′ wide sections				

*Where the enrollment is such that it is necessary to seat more than 100 pupils, two reading rooms should be provided—a general reading area and a reference research area.

**For a combined elementary and secondary school with enrollment up to 500 pupils, the reading rooms should seat not less than 20 to 25% of the enrollment, but not less than 65 pupils, allowing 30 sq. ft. of floor area per pupil.

#Recommended minimum.

##After deducting picture book collection of 1000 titles (¼ of assumed basic elementary book collection of about 4000 volumes).

Note: JUNIOR SECONDARY SCHOOLS. In estimating space for library reading rooms in junior high school buildings housing 1200 to 1500 pupils, seat, as a minimum, 8% of enrollment @ 30 sq. ft. per pupil. This would provide reading room areas ranging from 2880 to 3600 sq. ft. in these schools.

2

Section

72.33 Equipment as follows:

72.331 Shelving

a. The shelving available from the manufacturers of standard library furniture has proved most satisfactory and is recommended for all areas of the library quarters (except the work-storage room where less expensive shelving may be used) because of its good construction, its standard and accurate measurements, its use of seasoned, well-finished hardwood, and the provisions for easy self-adjustability.

b. If millwork shelving is used, ALL of the following specifications should be met:

(1) All shelving sections should measure three feet in width to avoid sagging and to allow shelves to be interchangeable among sections.

(2) If available wall space is not divisible by three, it is better to have one odd section than to divide the space equally into sections of non-standard widths.

(3) The use of seasoned hardwood avoids warping, sagging, and shrinkage (plywood is not suitable for shelving).

(4) The omission of projections (facings) along uprights or tops, all of which obstruct the removal of books.

(5) The use of grooves cuts for the placement of the metal strips to make shelves adjustable and the placement of these strips not more than 1¼″ from strip center to the edge of the shelf to prevent pulling out.

(6) The use of a veneer or composition board backing on all shelving.

(7) A slanting bottom shelf is not recommended.

c. Minimum shelving footage. See Table: 72.32.

d. Dimensions of shelving

Length	3′
Depth	
Standard	8″
Oversize	10″ to 12″
Thickness of shelves	¾″–⅞″
Height	
Jr. H.S. reading	6′
Sr. H.S. reading	7′
Counter shelving	30″–42″
Base	4″ to 6″
Cornice	¾″ to 1½″
Space between shelves in the clear	
Standard	10″
Oversize	12″
Uprights	¾″

72.332 Tables and Chairs

Table Item	Table Height	Table Width	Table Length	Chair Seat Height
Rectangular	30″	3′	5′	17″
Round or Square	30″	4′	4′	17″
Individual	30″	—	—	17″

Sturdy apronless tables are the most functional. Libraries with sufficient reading room space can create an informal atmosphere by the use of informal type design furniture.

Schools with grades K, 1–12, see also section 52.332.

Section

72.333 Charging Desk and High Stool or Chair. Rectangular, L-shaped, or U-shaped desks of counter or standing height should be large enough to circulate books, magazines, pamphlets, pictures, and various audio-visual materials. Regardless of shape or size, all desks should be movable. The desk for a school with an enrollment over 500 needs to be large enough for two people and provide two knee spaces.

Desks should be functional and simple in design, and should include shelves for returned books, a sunken charging tray area, and a drawer or two for cards, stamp pads, and other supplies. Desks made by millwork should meet specifications of state designs and the charging tray should be purchased. Avoid the use of non-functional cubby holes, drawer locks, and the like.

72.334 Card Catalog Case(s) with Base. Use standard library equipment only. Sectional cases are recommended to allow for later expansion, with a minimum of 15 drawers for the smallest high school, estimated on the basis of one tray for each 1,000 cards. All but the smallest school will need an additional catalog case in the workroom for the shelf list.

72.335 Vertical Files. A minimum of two four-drawer, legal size cases should be provided for the reading room, with additional filing space or cases, depending upon the size of the school, for the office or workroom.

72.336 Book Truck. At least one book truck should be provided in the smallest schools, sturdily constructed for long wear, equipped with ball-bearing hard rubber wheels, two of which are on swivels. Trucks with some slanted shelves are also available and are especially useful for taking books to classrooms or for display purposes.

72.337 Stands

a. Dictionary stand. In smaller schools, the counter height shelving for ready reference books can be equipped with a revolving dictionary stand as a substitute for a separate piece of equipment. Approximate dimension of dictionary stand:

42″ high, 21″ wide, and 14″ deep.

b. Atlas stand. Recommended for large libraries.

c. Periodical index table. A useful item for large libraries.

72.338 Display Areas

a. Tackboard or pegboard, mounted in frames and inserted temporarily into shelving sections can be placed in various parts of the room and relocated as desired. Do not place bulletin boards near the library entrance door.

b. Permanently located display boards should be used with caution and only when they do not take valuable wall space needed for shelving.

c. Wall type display cases, recessed, and facing the corridor outside the library are useful for publicizing its resources. Cases should be recessed, well-lighted, provided with locks, a combination of tackboard and pegboard backing, and appropriate shelving, such as glass. A case 4′ by 4′ by 18″ deep is recommended.

72.4 WORK STORAGE ROOM

72.41 Use. This room serves as a work area and storage facility for supplies, books, and back issues of magazines. This is where new books and other materials are received, cataloged, and processed for the shelves. Books are mended and materials made ready for binding. In some schools this area may also serve as the workroom-storage space for audio-visual materials (see section 73.0), and in smaller schools as an office for the librarian.

72.42. Circulation. The workroom should always have a door into the reading room and in many cases another door into the corridor. A small vision panel in the wall between the workroom and reading room is desirable only if the workroom must also serve as an office.

72.43 Space. The smallest school library needs at least 140 square feet for a work and storage area, and considerably more as the enrollment increases. If the workroom is to serve as a center for both housing and processing audio-visual materials and equipment, it should be increased by 120 square feet or about 20 square feet per hundred pupils over 200 when enrollment exceeds 800.

72.44 Equipment

a. A complete WORK UNIT should be provided to include a work counter 36″ high by 28″ deep which would cover a chart and poster storage cabinet four feet wide (28″ deep) made up of shallow drawers and one or two deeper drawers, about two feet of knee space, and a three foot wide sink unit. A two or three drawer file cabinet should be included next to the counter, along with a movable secretarial type desk 30″ high having knee space and a typewriter unit.

The work unit cabinets should be built with toe space.

At least two electrical outlets should be located for ease of use at the work counter.

A stool will be needed for the work counter and a chair on casters for the desk.

b. SHELVING (adjustable), should be placed on all remaining wall space with dimensions 7′ high, 3′ wide, and 12″ deep. Less expensive shelving may be used in this area of the library quarters.

c. BENCHES about 18 inches high by 44 inches long by 17 inches wide are useful for packing and unpacking boxes of books, supplies and other materials.

d. COAT CLOSET should be provided.

e. OTHER. As the size of the school increases, several additional pieces of equipment will be needed; a work table, chairs, more cupboard space, a card catalog case to house shelf list (six drawers—minimum).

72.5 PERIODICAL STORAGE ROOM. In schools with enrollments of 750 and over, a separate room for storing back issues of magazines should be provided. The average high school of this size will take at least 75 magazines, about two-thirds of which will be kept for reference for a period of three to five years.

If a vertical system of filing is used, it will require about 10 inches to house the issues of most weekly magazines for one year. Oversize weeklies, which are difficult to file vertically, require about three times this amount of space or about 30 inches for one year's issue. A year's supply of the average monthly magazine uses about 8 inches filed vertically and about 19 inches filed horizontally. Some additional shelving is needed for storing books, pamphlets, and other materials.

72.51 Space. 80 to 150 square feet. It is almost impossible to provide too much storage space in the school library quarters.

72.52 Location. Adjacent to the reading room and opening into it.

72.6 CONFERENCE ROOM(S). This area affords space for small groups to work together or engage in project activities. One or more rooms, if properly built (acoustically treated walls and ceiling, sound-proof glass, light and heat control, close fitting doors, well ventilated and properly equipped), may also be used by both teachers and pupils for listening activities and for previewing film strips.

72.61 Space. At least 120 square feet. When the enrollment exceeds 750 pupils, at least two conference rooms, each 120 square feet, should be provided.

72.62 Location. Adjacent to and connected with the reading room. Partitions, with clear glass windows above counter height shelving, will facilitate supervision.

72.63 Equipment. Provide: One wall of standard shelving, not more than five or six feet high, 8 to 10 inches deep; a counter (about 24″ wide and 36″ long) for phonograph and recorder, with shelves and dividers below for albums and recordings; one table (round or rectangular) and six chairs; a bulletin board 3′ x 4′ and about four to six lineal feet of chalkboard.

72.7 PREVIEWING AND LISTENING ROOMS. In schools where the provisions described in 72.6 do not include a room equipped for listening and viewing, a separate area for teachers and pupils to use for this purpose is desirable. The necessary projectors and other equipment for this purpose should remain within the room if the audio-visual center is not adjoining the library. Light control will be necessary.

72.71 Space. At least 200 square feet, in schools with 1000 or more pupils.

72.72 Location. This room should be connected with the audio-visual storage area, and the library reading room. See Section 73.0.

72.8 LIBRARIAN'S OFFICE. In schools with enrollments of 750 or more pupils, a librarian's office of about 120 square feet should be provided. This room will be used for teacher-librarian conferences, for examination and selection of new materials, for various kinds of bibliographical work, and various other professional tasks of the librarian.

72.81 Location. Adjacent to workroom and reading room with supervision of the reading room if possible.

Section

72.82 Equipment. Include: office desk and chair, one additional chair, a filing case, two or three sections of standard letter-size shelving 5′-6″ high; and a typewriter and table; one electric outlet and one telephone outlet.

72.9 PROFESSIONAL LIBRARY AND TEACHER'S WORKROOM. A room or separate space for the collection of materials for teachers, professional books and magazines, printed resource units, curriculum guides, and various kinds of materials and mechanical teaching aids is a desirable addition to the library quarters.

73.0 THE AUDIO-VISUAL EDUCATION CENTER

73.1 GENERAL. School districts must provide properly designed classrooms or teaching stations for the use of audio-visual materials and techniques. In addition, the district must provide appropriate spaces for the production of materials, and the distribution and storage of materials and equipment. The following general considerations should be reviewed for all new school buildings and the remodeling of existing buildings.

a. CLASSROOMS. Experience indicates that audio-visual equipment, materials, and methods make their greatest contribution to learning when they are used as a part of an instructional unit in the classroom at the exact time that a topic is being studied. The classroom is the center of instruction. Along with study and work areas, it should have adequate light control (darkening), climate control, electrical service, display and presentation areas—including a classroom projection screen, and storage facilities.

b. AUDITORIUMS AND OTHER PLACES OF ASSEMBLY. Spaces such as auditoriums, multi-purpose rooms, school lunchrooms, cafeterias, boardrooms, etc., should be designed for the use of audio-visual equipment for large or specialized groups of the school or community. These spaces should not take the place of the classroom for instructional purposes. Where necessary, public address, arc-projection, and other large group presentation devices should be included. The controls mentioned for the classroom would also apply to these areas.

c. THE AUDIO-VISUAL EDUCATION CENTER. The audio-visual education center provides a resource service that supplies teaching and learning equipment, materials and ideas to the teaching staff and can be described as:

(1) a place in which new and varied materials are planned, produced, experimentally tested and evaluated by teachers with the aid of audio-visual directors or coordinators. The center should contain sufficient space for preview and audition of projected and recorded materials. Some phases of in-service training of teachers should also take place in this center.

(2) a service center where audio-visual education materials and equipment may be stored, catalogued, assigned to users, shipped and received. This center should be provided with materials and tools for the preparation of slides, transparencies, maps, charts, graphs, models, mock-ups, flannel boards and duplicated materials. The tools and materials necessary to accomplish these objectives should be supplied in all audio-visual centers.

Section

73.2 ORIENTATION. The audio-visual education center and the library center should be in a central location, preferably on the ground floor.

When a DISTRICT AUDIO-VISUAL EDUCATION CENTER is located in a secondary school building, an outside EXIT is desirable near the audio-visual center for the movement of equipment and materials to other school buildings in the system. In large multi-storied buildings, an ELEVATOR is desirable near the audio-visual center for easy movement of equipment and materials between floors.

73.3 AUDIO-VISUAL EDUCATION PERSONNEL AND SERVICE AREAS

73.31 Personnel. An audio-visual education director administers the Audio-visual Education Program for the entire school system when the school system has a number of attendance units. An audio-visual education coordinator is in charge of the Audio-visual Education Program within a single school building having only one attendance area. A large system may employ a director, coordinators, technicians, and other personnel.

73.32 Service Areas. The service areas to be provided in an audio-visual education center in a new building will depend on: (1) the present and future local audio-visual education program, (2) the enrollment and grade level of the school building or system, and (3) whether the audio-visual center is serving only the building in which it is located or is a district center serving a number of buildings in the system. Service areas to be provided will include the following:

(1) A-V equipment storage and distribution.
(2) A-V materials and storage and distribution.
(3) A-V equipment inspection and repair area.
(4) A-V teaching aid planning and producing area.
(5) Dark room.
(6) Photographic area.
(7) Reproducing area: reflex, ditto, mimeo., etc.
(8) Preview and auditioning area.
(9) T.V. Studio.
(10) Office for A-V director and any technical or other personnel.

73.4 AUDIO-VISUAL EDUCATION EQUIPMENT

a. EQUIPMENT STORAGE. A basic minimum list of audio-visual education equipment needed in a good instructional program may be obtained from the state supervisor of audio-visual education. For school officials, the basic minimum list may also be found in the "Administrative Manual for Minnesota Public Schools," Part II, Section 5.00.

Not all the equipment in the basic minimum list or in any A-V center's inventory needs central storage. Certain equipment items such as overhead projectors, tape recorders, filmstrip viewers, filmstrip and slide projectors, used almost daily in the classroom, may be assigned to teachers for varied periods of time, in some cases for six or more months or for the entire year. All items are recalled for periodic inspection and necessary repair.

The purpose of the following list is to indicate some of the types and kinds of equipment and the number of each for which storage space and storage facilities are needed in the A-V Center. The list is only representative of the total A-V equipment needed in a building for program purposes.

AUDIO-VISUAL EQUIPMENT	MINIMUM NUMBER OF UNITS
(1) 16mm sound motion picture projectors*	1 per 240 pupils or 8 teachers
(2) 16mm silent motion picture projectors (such as for analytical motion studies*	1 per school system
(3) 8mm sound and/or continuous motion picture projectors	1 per school system
(4) Filmstrip and 2 x 2 projectors	1 per 150 pupils or 5 teachers
(5) Opaque projectors*	1 per building or 600 pupils or 20 teachers
(6) Overhead projectors*	1 per 300 pupils or 10 teachers (as stand-by or reserve equipment)
(7) Microprojectors	1 per building
(8) 3¼ x 4 slide projector	1 per system
(9) Record player (4 speed)	1 per 150 pupils or 5 teachers
(10) Tape recorders*	1 per 180 pupils or 6 teachers
(11) Radio receivers	1 per building
(12) Television receivers*	5-7 units per building
(13) Portable projection screens, tripod type	2–3 per building
(14) Projection carts	5–7 extra units for transporting miscellaneous equipment
(15) Closed circuit (direct wire)	1 per building
(16) Video tape recorder	1 per system

---

*On carts. Supply space in storage room for cart and attached equipment.

Section

Section

b. A-V EQUIPMENT—INSPECTION AND REPAIR. An area should be provided which is designed to house:

(1) Work bench with electrical outlets; tool panel.
(2) Storage for parts, for stand-by equipment, and for equipment and materials needing repair.

73.5 AUDIO-VISUAL EDUCATION MATERIALS

a. STORAGE. Audio-visual education materials for which storage space must be provided (see Note) includes the following:

(1) Models
(2) Mock-ups
(3) Dioramas
(4) Specimens
(5) Museum materials
(6) Still or flat pictures
(7) 2" x 2" slides
(8) Filmstrips
(9) Overhead transparencies
(10) Phonograph records
(11) Magnetic tape recordings
(12) Transcriptions
(13) Video tape recordings
(14) Motion pictures
(15) Maps and globes
(16) Charts
(17) Graphs
(18) Posters
(19) Flannel board materials

NOTE: Some of the above materials may be assigned storage in classroom or library areas.

b. STORAGE EQUIPMENT. In the audio-visual materials storage area, provide:

(1) Racks for storage of maps and screens.
(2) Filmstrip cabinets or drawers, film racks.
(3) Record cubicles and tape shelves.
(4) Picture poster slots, transparency and slide drawers.
(5) Storage for specimens.

c. DISTRIBUTION. The storage space for audio-visual education materials should be located for distribution by audio-visual personnel.

73.6 MATERIALS PRODUCTION AREA.

This area in the audio-visual education center should provide: (1) for the construction of teaching materials such as exhibits, charts, slides, posters, models, overhead transparencies, and programmed learning sequences for teaching machines, (2) reproduction of printed materials.

a. The materials production area should be equipped with:

(1) Work counter and layout table.
(2) Sink with hot and cold water.
(3) Electrical outlets to carry the load of duplicators and small power tools.
(4) Tool cabinet for small hand tools.
(5) Storage space for construction and duplicating materials, including paper, wood, plastic, metal.

b. The following production devices (minimum number of units) must be provided in the materials production area;

Production Devices:	Minimum Number of Units
(1) Transparency duplicators	1 per building
(2) 35mm still camera	1 per building
(3) 16mm motion picture camera	1 per school system
(4) Drymount press	1 per building
(5) Lettering devices	1 per school building
(6) Photo copy equipment—opaque material	1 per building
(7) Duplicating equipment	1 per building
(8) Illuminated drawing tables	1–2 per building

73.7 EXAMPLES OF AUDIO-VISUAL EDUCATION CENTERS FOR VARIOUS SIZES OF SCHOOLS

a. HIGH SCHOOL BUILDING WITH UP TO 500 PUPILS (UNDER 25 TEACHERS)

(1) Receiving, booking, and distribution area.
(2) Audio-visual materials storage area.
(3) Audio-visual equipment storage area.
(4) Audio-visual equipment inspection and repair area.

(5) Materials production area—for planning and producing teaching aids, and reproducing printed materials.
(6) Preview and auditioning area—for previewing films and film slides, and auditioning records and tapes.

Suggested Space: about 435 to 525 square feet, or a half-classroom to slightly more than one-half a classroom.

b. HIGH SCHOOL BUILDING WITH 500-1500 PUPILS (25 OR MORE TEACHERS)

Educational Specifications and Suggested Space: Provides in an over-all space (suite) of about 870–1075 square feet the following:

(1)	Office and check-out counter	180 sq. ft.
(2)	Preview room and studio	136 sq. ft.
(3)	Dark room: Print room	84 sq. ft.
	Film room	35 sq. ft.
(4)	Space for: Audio-visual materials storage Audio-visual equipment storage Audio-visual equipment inspection and repair Materials production and reproducing devices	640 sq. ft.#
	TOTAL	1075 sq. ft.

#For some schools this space may be about 325 sq. ft., reducing the total space to about 870 sq. ft.

NOTES:

(1) Space—item "(4)" above contains a recording counter separated from the studio by a double glazed window.

(2) There should be provision for the interconnection of control wires between the studio and recording area outside, with a panel on each side for mounting jacks.

(3) The acoustically treated preview and recording studio can also serve as a conference room when provided with table and chairs. A double glazed window in the partition wall and a soundproofed door are essential for control of the recording activities.

c. HIGH SCHOOL BUILDING WITH OVER 1500 PUPILS (SYSTEM OF 100 OR MORE TEACHERS)

Educational Specifications and Suggested Space: Provides in an over-all space (suite) of 2466 sq. ft., including a studio-classroom of 840 sq. ft. which is optional, the following approximate areas:

(1)	Office for A-V director and personnel	140 sq. ft.
(2)	Preview room and small studio	154 sq. ft.
(3)	Control room	112 sq. ft.
(4)	Combination T.V. studio and classroom (OPTIONAL)	840 sq. ft.
(5)	Space for A-V equipment and materials storage, distribution, inspection and repair; materials production	1060 sq. ft.
(6)	Dark room: Print room	112 sq. ft.
	Film room	48 sq. ft.
	TOTAL	2466 sq. ft.

NOTES: (1), (2) and (3) as stated in "b." preceding apply to the audio-visual education center described in "c.", as well.

73.71 Layouts. Layouts for the audio-visual education centers for which approximate areas and space are indicated in 73.7 a., b. and c. preceding are obtainable upon request from the State Department of Education, School Plant Planning Section or Audio-visual Education Unit.

73.8 OTHER FEATURES, AUDIO-VISUAL UNIT

a. ELECTRICAL SERVICE

(1) Provide the A-V Unit with separate, fused electrical panel.
(2) Locate no transformers in the immediate area of A-V Unit.
(3) Place many well-located electrical outlets in the A-V Unit.
(4) Equip the preview room with a lighting circuit having rheostat controlled incandescent lights and one circuit with regular fluorescent lights.
(5) In small, one-room A-V Units used for combination preview and equipment storage purposes, provide a separate lighting circuit in the preview area.
(6) Equip the print and film darkroom areas with photographic safe-lights on a separate switch from the regular lights. Locate incandescent white lights in an unnatural location to prevent accidental turning on.
(7) Main closed circuit T.V. service should be extended into the recording and studio production areas of large A-V Units.
(8) Provide an outside telephone line in the A-V director's office and two-way communication to the administrative office and to each classroom.

b. VENTILATION. Provide:

(1) At least 4 air changes per hour in each A-V Unit room.
(2) Separate exhaust to outside from darkroom and production area.

c. DARKROOMS. Desirable features:

(1) A-V Unit darkrooms are designed as instructional service centers.
(2) Print and film arrangements should be such that a person may work from left to right.
(3) Counter tops should be of acid resisting materials such as No. 317 stainless steel or fiberglass.
(4) Print and film darkroom sinks should be equipped with automatic temperature blenders and mixing type faucets. The print washer should have water outlets of adjustable heights so that water may be circulated at an even temperature and at variable heights.
(5) Dark room light traps should be painted flat black to reduce reflection.
(6) Darkroom sliding door thresholds and ventilators should be light-proof.

d. MISCELLANEOUS

(1) Shelving for A-V machines should be adjustable, about 18″–24″ deep by 36″ or more long, and so designed that the shelves do not tip, sag, or pull out as equipment is being removed.
(2) The screen in each preview area may be of conventional type or a smooth, flat, white painted surface on a wall, at least 70″ x 70″.
(3) For flexibility, provide movable work counters and storage cabinets whenever possible.
(4) Any windows in A-V Units must have good daylight control devices.

Section

73.9 District Audio-Visual Education Center. Experience has shown that generally each school district maintaining a number of school buildings (attendance areas) should provide a central audio-visual education center managed by a director. The district audio-visual education center should contain materials and production facilities to serve the general needs of schools. Coordination of the services of the district audio-visual education center and the service and activities of individual building auxiliary audio-visual education centers is obtained through the building A-V coordinator in charge of the local audio-visual education program under the direction of the district A-V director.

SECTION 74.0 MODERN FOREIGN LANGUAGE FACILITIES

Section

74.01 General. The philosophy of teaching modern foreign languages has changed completely during the past two decades. Today the audio-lingual method with its emphasis on listen, speak, read, write in that order, is winning growing acceptance by teachers of foreign language and school administrators.

Since research indicates that the spoken language gains in relation to the immediate visual context, specialists in the field have reinforced the audio-lingual method with visual aids—the motion picture projector, over-head projector, opaque projector, slide and film strip projector, with recent developments suggesting for the future the use of video tape.

With this change in objectives and techniques, facilities for modern foreign language classes have also changed. The traditional classroom has been modified to allow for the use of electro-mechanical equipment and coordinated visual aids. Many schools are providing, as a supplement to the classroom, complete language laboratories with extensive installations of equipment for listening, speaking, and viewing.

Through the language laboratory, many of the limitations on instruction in the classroom at the first two levels: listen, speak—may be alleviated. For example:

(1) Every pupil responds to each drill item in listening and speaking, thus giving every pupil the full advantage of the laboratory drill session.
(2) The teacher can shift much of the burden of tiring repetition to untiring, authentic models of speech for imitation and drill.
(3) Class size can be kept at an efficient level. The language laboratory is adapted to large group laboratory instruction and team teaching, if desired.
(4) The equipment can provide for individual differences in learning.
(5) The equipment makes possible the testing of listening and speaking skills in a variety of ways.
(6) The pupil can use records and tapes for drill and practice after school and at home.
(7) Tapes, records, and films have been designed by teams of language teachers, specialists and psychologists to teach specific linguistic skills and to supplement most commonly used secondary texts. Few language teachers can undertake such a vast project.
(8) Teachers who are not native can present a variety of voices, accents, and situations, including native music and songs.
(9) In schools with large foreign language programs the installation of a foreign language laboratory can, in some cases, actually result in the saving of space devoted to instruction, releasing a room for use by another class.

74.1 General Foreign Language Classroom

a. Where a language laboratory is provided, the general foreign language classroom is the facility in which the teacher introduces new material in listening and speaking for later practice in the laboratory. Following laboratory drill the classroom provides opportunity for practice of the language and is used for basic work in reading and writing the language.

Section

b. Where a language laboratory is not provided, the general foreign language classroom must be a flexible facility for perfecting the listening, speaking, reading and writing skills. In this circumstance, the installation of a number of student laboratory positions is desirable.

74.11 Student Laboratory Positions in General Classroom. A selected number of student laboratory positions may be located on a perimeter wall of the general foreign language classroom, facing a projection screen. See Sec. 74.22 for possible types of installations.

Minimum: Each student position may have a headphone jack and a volume control or may be equipped with a standard half-track tape recorder, preferably the cartridge type, with headphones. The student positions must be connected to the program source at the teacher's desk. Wiring between the program source and the student position may run by a flat floor mold conduit or along a side wall. The advantage of supplying each student position with a tape recorder is that each pupil may make his own copy of the teacher's lesson material on tape, record his own responses and compare with the model. The pupil may view projected material coordinated with the teacher's lesson material on the screen.

74.12 Classroom Size. If no class will exceed 30 pupils the general foreign language classroom should approximate 900 sq. ft. Allow about 30 sq. ft. per pupil, including space for some laboratory equipment.

74.13 Chalkboard, Tackboard, Display. Provide:

(1) Approximately 20 lineal feet of chalkboard, 42 inches high on the front wall.
(2) A minimum of 20 lineal feet of tackboard, 42 inches high on one side and/or in the back of the room.
(3) Combination map rail and tack strip at the top rail of chalk and tackboards.

74.14 Lighting. If fluorescent, suppressors or static resistors must be installed.

74.15 Electrical Outlets. Provide at least 6 outlets as follows: 2 at the front of the room; 2 on each side, equidistant from the front and back. If a number of student laboratory positions are to be installed, provide a plugmold convenient to them, with 10 outlets minimum. All outlets should be 36" above the floor.

74.16 Acoustics. The ceiling of the foreign language general classroom should be acoustically treated. Parallel blank walls should be acoustically treated on one side.

74.17 Loud Speaker. Provide each foreign language classroom with a loud speaker of high quality (response, 36–14,000 cycles per second; crossover, 2,000 cps., capacity 25 watts, impedance 16 ohms. Mount the speaker on a convenient wall, 7 feet from the floor, clear of any wall screen. It should be possible to play the tape recorder, record player, or to listen to the sound track of a film through the speaker when desired.

74.18 Other Equipment Needs. These will include: a record player and tape recorder as permanent equipment, an overhead projector, opaque projector, slide and film strip projector, and permanently mounted wall screen.

74.2 LANGUAGE LABORATORY. A language laboratory is an installation of electro-mechanical equipment which provides the pupil with an opportunity to practice and learn a language more efficiently and more effectively than in the classroom. A complete language laboratory consists of a room occupied by student booths or stalls, wired to a central control console which distributes programs for pupil language study. The laboratory relieves the teacher of conducting routine drills. He may consequently concentrate on imaginative and flexible language practice during the lessons conducted in the language classroom.

74.21 Basic Types. These are:

(1) Regular Class Assigned Group Use—a part of the regular class assignment; class uses the lab 2–5 half-hour periods each week on a group basis, directed by teacher; commonly used in secondary schools.

(2) Independent Study Facility—Individual Use: a supplement to classroom instruction; each pupil uses the lab on an individual basis whenever his schedule permits; commonly used in colleges; some specialists recommend for secondary schools.

74.22 Kinds of Language Laboratory. There are several types of language laboratory installations:

LISTENING STATION (Audio-Passive). This installation is simple, consisting of little more than a record player and/or tape recorder as the teaching center. The lesson, from tapes or records, is directed to the student by means of earphones to lessen distractions. The pupil has the opportunity to hear models other than his teacher. Ordinary classroom furniture is utilized, the earphones plugging into ordinary telephone jacks located along the wall, on the desks or tables, or on the recorder itself. The system is not a true langauge laboratory as the pupils are unable to hear themselves as they actually sound. The system is small, portable, but has limited versatility.

LISTEN-RESPOND (Audio-Active). Here a record player and one or more tape recorders are grouped together at a teacher control center or console. The teacher's master control switch panel enables her to (1) select proper tape for each student, (2) monitor any student, (3) talk to any student, (4) record any student, (5) talk to any row, or to the entire class. The student hears the lesson source through earphones, and gives the required response. The pupil's voice is picked up by his microphone, amplified, and the amplified response is returned to the pupil's earphones. He hears himself as he actually sounds and can compare his own response with the lesson model.

LISTEN-RESPOND-RECORD (Audio-Active-Compare). In this system the teacher's console and student positions are the same as in the LISTEN-RESPOND type except that each student position is equipped with a tape recorder in addition to earphones and microphone. The pupil listens through his earphones to a master tape recording from the master console, responds into his microphone, hearing himself instantaneously. In addition, he records the model and his own voice on the recorder. (The recorder can be located at the student booth, at the teacher's console, or in a remote cabinet.) This system requires more time per lesson since the lesson must be reviewed, compared, and evaluated but the learning is more intensive.

INDIVIDUAL STUDY OR LIBRARY TYPE. Can be any one of the previously listed types, except each student can work independently at his own level and rate with master tapes on his own recorder. Can be used for group as well as individual study.

74.23 Language Laboratory Equipment Components.

a. FOR THE GROUP (Usually at the teacher's console)

(1) Record player—Teacher can play records.
(2) Tape recorder and playback—Teacher can make recordings and play master tapes; can also record student responses.
(3) Control panel—Teacher can monitor, record, and communicate with any pupil, with groups, or the entire class.
(4) Many program sources—Teacher can direct many different programs, usually from four or more channels, to different students.

b. FOR THE PUPIL (At his student position, usually a booth)

(1) Headphones (earphones)—Pupil can listen to recordings.
(2) Microphone—Pupil can listen and respond, hearing his own voice.
(3) Student tape recorders—Pupil can record both the master and his own voice and compare.
(4) Individual tape recorder—Pupil can use master tapes at his own rate to suit his own needs.
(5) Volume control.

c. COORDINATED VISUAL AIDS. Projected materials are commonly coordinated or integrated with laboratory practice drills. Pictures make clear what the conversation is about and also present the culture of the people. Equipment for this purpose may include: overhead projector, opaque projector, slide and film strip projector, motion picture projector, and permanently mounted wall screen.

d. LOUD SPEAKER. The loud speaker will be used for general listening in both classroom and laboratory.

e. TEACHER CONSOLE. This is a control console for supplying and distributing lesson programs, monitoring, and inter-communication, and, if desired, remote recording of a pupil working at a booth. For effective laboratory administration place the console on a platform 6 to 18 inches high. Some specialists recommend enclosing or semi-enclosing the teacher console with acoustical and glass panels. This would permit the teacher to listen and communicate with pupils through a loudspeaker, without the use of earphones. In some schools, the teacher console is located in a room behind the pupils above the level of the laboratory.

f. BOOTHS. Sound absorbent partitions or dividers are commonly used between student positions both to improve the use of sensitive microphones and amplifiers and for the psychological advantage of semi-isolation of the pupil. Dividers should be just high enough to shut out the vision of pupils on either side when the pupil is seated. A standard size for booths is 30 or 36 inches wide by 36 inches deep by 54 inches high from floor. The solid booth front should be no higher than 10 to 12 inches and may be completed with a glass panel. For unimpaired line of vision from student booth to teacher console and wall screen: (1) install pupil booths on a tiered floor, (2) use a chevron design for placing booths, (3) use drop-down fronts on booths.

g. EQUIPMENT SPECIFICATIONS. In the planning process of a language laboratory a conference with the Modern Foreign Language Consultant, State Department of Education, on proposed equipment and specifications is essential.

74.24 Determining the Number of Student Positions. The amount of ultimate estimated use must be established. Once this decision has been reached the number of pupil positions can be computed by the following formulae: (Most schools attempt to schedule the laboratory at least one-half period per day if it is at all possible, especially for beginning learners. Students at advanced learning levels need not spend this much time in the laboratory.)

MAXIMUM USE: One-half period a day for each pupil. (It is generally conceded that a pupil should not spend more than 20–30 minutes per day in the laboratory.)

NOTE: Ideally in a 60 minute period: 15 minutes—classroom; 15 minutes—laboratory; and 15 minutes—classroom; 15 minutes—laboratory.

$$\text{Number of Student Positions} = \text{Largest Class Enrollment} \times \frac{\text{SETS*}}{2}$$

---

*A SET is defined as the largest number of foreign language classes taught in a school during any period of the school day. The quotient of SETS/2, if not a whole number is rounded to the next higher number.

MINIMUM USE. One full period (2 one-half periods) per week.

$$\text{Number of Student Positions} = \text{Largest Class Enrollment} \times \frac{\text{SETS}}{5}$$

NOTE: When the number of student positions has been established, increase this amount by 2 or 3 stations to take care of the possibility of equipment failure at a student position and some future growth.

74.25 Space. A space of about 900 to 1000 sq. ft. will provide 1—30–35 station language laboratory, including space for a recording room. Allow about 30 sq. ft. per pupil station in estimates.

For large schools using the audio-lingual approach to language learning and interested in large group instruction and team teaching, a space of about 1700 sq. ft. will provide 1—60 station divisible language laboratory and recording room. In such a school groups of up to 60 pupils would be taught in the language laboratory, equipped to suit the local program—Listen-Respond, Listen-Respond-Record (or combination). Language classrooms would house up to 30 pupils, with some classrooms divisible for small group instruction to 12–15 pupils.

INTERNAL TRAFFIC. Pupils must be able to pass easily from their classrooms to the laboratory while other pupils are going to the laboratory. Careful consideration must be

given to the door arrangement as 50 to 60 pupils, or more than 100 where large group instruction, will be changing rooms between or during class periods. In the laboratory, consideration must be given to convenient access to and from booths by pupils and convenient access by teachers to console, to all pupil stations, and to the recording room. The normal minimum spacing between one booth to the one ahead is 5 feet, with 6 feet spacing desirable.

74.26 Location

a. EXTERNAL NOISE. Select a location in the building which is subject to least interference from external noise sources, i.e., playground area, high density highway traffic, jet airport approaches, industrial areas.

b. INTERNAL NOISE. Keep as far removed from high internal noise sources as possible. These include: gymnasium, music practice room, auditorium, lunchroom, shops. Noise from air conditioning and heating equipment must be kept at a minimum.

74.27 Sound Treatment. Ambient noise levels limited to the 34–40 db range are highly desirable for language laboratories. Reverberation time in the order of .8 second is quite good for a 10,000 cu. ft. laboratory. Acoustical tile made of mineral fibre rated "Class C" or higher are recommended both for room treatment and for laboratory student position dividers. See Section 106.8 ACOUSTICAL DESIGN STANDARDS.

74.28 Electrical

a. Wiring from console to student booth area should be provided in a flexible easily changed under floor electrical duct system.

b. Student position power circuits should be fused and controlled from the console or from a convenient wall box.

c. Wiring at each booth should be located and designed to minimize tampering and accidental injury to pupils and equipment. All electric connections should be concealed and protected.

d. Wiring should be accessible and easily alterable. Circuits should be designed to permit checking and servicing with a minimum of interruption of instruction.

e. A master switch should be provided that will turn off the electric power service in the laboratory except service for the overhead lights.

f. Special attention should be given to the artificial lighting as dividers at student positions reduce much of the reflected light normally available in the classroom.

g. A metal raceway to carry audio wires should be provided from the console area through each row of booths. Where audio wires are to be brought out of the raceway, a bushed hole or suitable plug should be provided.

74.29 Other Features

a. VENTILATION. Individual room ventilation control is especially desirable in the language laboratory where heat is generated from a number of sources (windows, students, lighting, equipment), and where a high degree of concentration is demanded. Heating and air conditioning equipment should not introduce a noise level of more than 45 db.

measured at the student position. Transistorized equipment will reduce both the power and cooling requirements.

b. WINDOWS. Windows have little to justify their use in a full-time language laboratory. In new buildings it is suggested that windows be limited to 100 sq. ft.

c. FLOORS. Laboratory floors should be durable, resilient and quiet. The use of carpeting may be a good answer.

d. DOORS. Doors that close quietly and automatically are necessary when loudspeakers are part of the laboratory program. When headphones are used, sounds of doors opening and closing are not seriously distracting.

e. STORAGE. Adequate storage should be provided for tapes, records, student books, equipment, cards, and spare parts. Storage for tapes and records should not be located close to any source of heat or strong magnetic field. Tapes and records should be stored upright, never flat.

In the recording room, there must be considerable storage for tapes on reels and in cartridges. A storage wall with sliding, lockable doors is suggested. Movable shelving is recommended. Storage for tapes must be near the teacher console to be readily accessible.

f. RECORDING ROOM. A recording room should be provided to insure good recordings. About 100 sq. ft. of space is required. It should be equipped with double doors or a Riverbank type door, acoustical treatment on ceiling and walls, incandescent lighting and a heating and ventilating system as silent as possible. Provide enough electrical outlets for several recorders, microphones, and record players.

g. PROJECTION ROOM. A projection room centered beyond the rear or front of the laboratory is desirable. This room can also be used for the storage of such equipment. An input for sound from films should be located in the projection room or at the rear of the laboratory if no projection room is provided.

h. OFFICE AND WORK AREA. Office space and work area of at least 150 sq. ft. should be available adjacent to and connected with the laboratory. Provide considerably more if major repairs are made in school by a supervisory teacher and lab team. A window permitting visual supervision of the laboratory is desirable. The work area should be equipped for editing and duplicating tapes, listening to student recordings, previewing visual materials, storing tapes, etc. It is possible to combine the recording and work area if space is limited.

74.3 THE ELECTRONICS CLASSROOM. Some schools wish to have some of the advantages of the language laboratory but feel that the facility must be contained in the foreign language classroom. Other schools feel that there is merit in having electronic equipment always accessible so that some tape drills may be used during every class hour. This thinking has stimulated the development of the "electronic classroom," a classroom which can be readily converted into a laboratory-like installation.

74.31 Features of the Electronic Classroom

a. In the electronic classroom each student position (desk or table) is wired for electrical components. All wired pupil furniture is permanently secured to the floor.

NOTE: Another possibility is perimeter wiring in the language classrooms with a mobile console that can be wheeled from room to room. In this arrangement the pupil furniture may be kept portable to use in groups in other class activities.

b. The kinds of electronic classroom (type of system installed) may be the same as in the language laboratory.

c. In the audio-passive set-up, the teacher programming source may be as simple as a record player or tape recorder, or may be equipped to send a number of programs to the desired student positions. Pupil equipment is limited to headphones.

d. In the audio-active system, the programming center may vary considerably in complexity depending upon the functions desired. Teacher equipment will include a program center (which may be a console), headphones and microphone. Pupil equipment will include headphones, microphone, and amplifier to activate the headphones. The quality of the equipment should be the same as for language laboratory equipment.

e. Sometimes pupil positions are equipped with convertible booth equipment. This equipment features folding partitions which create some pupil isolation when raised. When lowered, such partitions generally cover the electronic equipment and conventional classroom activities are possible.

74.32 Other Facilities and Equipment

a. A small room (about 75 sq. ft.) at the rear of the electronic classroom is highly desirable. This room should have work space, recording space, storage space, and may serve as a projection room for visual aids.

b. An overhead projector, opaque projector, motion picture projector, and slide and filmstrip projector are desirable auxiliary equipment for the electronic classroom.

74.4 MAINTENANCE—A SPECIAL CONSIDERATION. When planning for a language laboratory, not only the initial cost should be considered but the annual cost to maintain it. Such questions as the following must be answered: Is the school system willing to provide the money for essential supplies and equipment? Is a technician or technical assistance for repairs going to be available at all times? If these questions can be answered affirmatively, it is the general concensus that a good language laboratory is well worth the money put into it in terms of pupil growth and proficiency in a modern language gained by this method.

SECTION 75.0 SCIENCE FACILITIES

Section

75.1 GENERAL

75.11 Types of Science Facilities. In Minnesota, science rooms are typically equipped to provide both classroom and laboratory instruction in a single CLASSROOM-LABORATORY UNIT. When a classroom-laboratory unit is equipped with facilities for instruction in several subject areas such as junior high science and biology, or biology and chemistry, or biology, chemistry, and physics, it is termed a MULTI-PURPOSE CLASSROOM-LABORATORY.

75.12 Classroom-Laboratory Units—Activities and Spaces in Which Located

(1) GROUP INSTRUCTION: demonstration, lectures, recitation

SPACE: Classroom area with pupil tables or desk-chair units providing a flat working surface, placed so that pupils may view teacher demonstration unit, chalk board, and projection screen.

(2) LABORATORY INSTRUCTION: for individual and group experiments

SPACE: Laboratory instruction is provided at selected perimeter wall tables or counters, equipped with water, gas, and electric utilities, or 4-pupil peninsular tables, or at island tables in the central room area. When water and gas services are not required, some laboratory instruction may be given at pupil tables in the classroom area.

*(3) STORAGE OF SUPPLIES AND EQUIPMENT

SPACE: Involves, in addition to perimeter storage in the science room, a special storage area or room, which may serve more than one science room.

*(4) INSTRUCTOR PREPARATION OF TEACHING MATERIALS

SPACE: Preparation area or room, equipped with counter, sink, and needed utility services; adjacent to storage area.

*(5) INSTRUCTOR CONFERENCE AND PLANNING

SPACE: Office, conference and planning area; can be incorporated with preparation area.

*(6) INDIVIDUAL STUDY-RESEARCH: by talented pupils

SPACE: Advanced project area with lab counter, sink, service utilities, and reference shelving.

Section

75.13 Program. Junior high science, traditionally general science, may take the form of a specialized science such as life science, earth science and physical science. Senior high school science which usually consists of courses in biology, chemistry, and physics will probably continue in these areas but will offer instruction at more advanced levels. Science subjects vary in the proportion of laboratory instruction as well as subject matter. Laboratory activities should be primary in both junior and senior high science. The facilities described will accommodate many other specialized courses in science.

75.14 Enrollment. In the JUNIOR SECONDARY PERIOD, junior high science is a constant subject. It is required a minimum of one semester or equivalent in grades 7 and 8, or a full year in grade 8. Science is required a full year in grade 9. Consideration should be given to the inclusion of a full year of science in grades 7 and 8 as well as 9.

In the SENIOR SECONDARY SCHOOL PERIOD, science needs will depend upon the size of the school and the percent of the total enrollment electing biology, chemistry, physics, or related courses. It is desirable that every college-bound pupil take a minimum of two credits in science. Local science programs should be carefully evaluated and reviewed in planning new science facilities. Provisions for implementing the modern courses in senior high science and reorganization in junior high science should not be overlooked.

75.15 Class Size. Science classroom laboratories are usually equipped to accommodate 24–28 pupils in junior high science as well as in classes in biology, chemistry, and physics.

75.16 Number of Teaching Stations. The following formulas are adequate to determine the number of science teaching stations. For each subject:

$$(1)\ \text{NUMBER OF SECTIONS} = \frac{\text{Subject enrollment}}{\text{Class size}}$$

$$(2)\ \text{NUMBER OF TEACHING STATIONS} = \frac{\text{Number of sections}}{\text{Periods, less 1, in daily schedule}}$$

EXAMPLE: Junior-Senior High School—6 period daily schedule.

---

*Auxiliary facilities. Can be provided for in a space between two science rooms, serving both, and with access from each.

Subject	Ultimate Enrollment	Class Size	No. of Sections	Available Periods	No. of Teaching Stations
Life Science 7#	250	25	10	5	2
Earth Science 8#	250	25	10	5	2
Physical Science 9	300	25	12	5	2.4
Biology	225	25	9	5	1.8
Chemistry	175	25	7	5	1.4
Physics	150	25	6	5	1.2
TOTAL NUMBER OF TEACHING STATIONS					10.8

#Full year each.

Types of science rooms for the indicated number of teaching stations are suggested as follows:

Subject	Junior High Classroom-Lab	Single Subject Classroom-Lab	Multipurpose Classroom-Lab
Junior High Science grades 7, 8, 9	6.4	———	———
Biology	———	1.8	———
Chemistry	———	1.4	———
Physics	———	1.2	———
(Fractions)—junior high science, chemistry and physics	———	———	1
Total science rooms	6	4	1

Section

75.2 Suggested Features of Single Purpose and Multipurpose Science Units

75.21 Junior High Science

Size. Suggested floor area (approximate) for a 28 pupil classroom-laboratory:

	Sq. Ft.
Classroom-Laboratory: 28 pupils @ 52½ sq. ft. per pupil	1470
Auxiliary facilities: for 2 classroom-laboratories	630#

#May include:	Sq. Ft.
(1) Office, conference, preparation and storage areas for two instructros	378
(2) Plant room and storage	126
(3) Animal room and storage area	126

Equipment, utilities, arrangement. See: (1) Suggested layout "Floor Plan for Junior High School Science Facilities," State Department of Education, School Plant Section; (2) "School Facilities for Science Instruction," National Science Teachers Association, Washington 6, D.C., 1961: General Science—pages 95–116.

Facilities unique to junior high science. Provide centers for pupil equipment construction, illustrating, display; special areas for plant and animal breeding; facilities for astronomy, geology, meteorology.

75.22 Biology. There is considerable similarity in the space and furniture needs of junior high science and biology. Movable equipment varies and the biology laboratory should have auxiliary plant and animal areas. These laboratories may therefore be used for either subject with careful planning of auxiliary facilities.

Size. Suggested floor area (approximate) for a 28 pupil classroom-laboratory:

	Sq. Ft.
Classroom laboratory: 28 pupils @ 52½ sq. ft. per pupil	1470
Auxiliary facilities: May serve two classroom-laboratories	630#

#May include:	Sq. Ft.
(1) Office, conference, preparation, and storage area for two instructors	294
(2) Student project area, plant room and storage areas	222
(3) Animal room and storage area	114

Equipment, utilities, arrangement. See Suggested Facilities—Biology, State Department of Education, School Plant Section. Also see "School Facilities for Science Instruction," National Science Teachers Association, Washington 6, D.C., 1961: Biology—pages 117–140.

Facilities unique to biology:

(1) Make extensive provision in biology room for growing tables, aquarium tanks, animal pens.

(2) Provide for microscope storage; or microscopes may be permanently mounted on work counter along one wall.

(3) Consider substage lamps with daylight filters for work with compound microscopes.

(4) Provide a utility sink in or near the laboratory for cleaning crocks and garbage containers; a garbage disposal may be provided in the preparation area and at the demonstration unit sink.

Section

(5) A refrigerator is desirable in the biology room or storage room.

(6) Provide separate temperature control and humidistat when plant and animal rooms are maintained; separate exhaust ventilation where plant and animal materials are stored; and provision for maintenance of temperature during extended vacation periods when temperature of plants may be lowered.

(7) The demonstration unit may be equipped with TV camera positioned to view a dissection and transmit the image to TV receiver(s) mounted above the demonstration table.

(8) Electric stove, four element, with oven.

Plant Room. An area of about 100 square feet is desirable for special plant projects in biology. This should be a separate room with at least 15 lineal feet of non-corrosive (aluminum, copper, etc.) frame racks 24″ deep, illuminated by south light or about 1500 foot candles of electric light to produce photosynthesis. There is a service sink with sediment trap, hot and cold water, floor drain, separate temperature control and humidistat, water resistant floor and materials at all locations. Plant rooms are sometimes located in bays or attached as "lean to" greenhouses.

Animal Room. This room, when provided, should be at least 100 feet in area, all surfaces "wash down," receptor sink with hot and cold water mix and hose connection, floor drain, counter space with storage beneath, humidity and temperature control provided for. Metal frames provide support to various sized animal cages. Electric outlets should be waterproof.

75.23 Chemistry

Size. Suggested floor area (approximate) for a 28 pupil classroom-laboratory:

	Sq. Ft.
Classroom-laboratory: 28 pupils @ 52½ sq. ft. per pupil	1470
Auxiliary facilities: to serve two classroom-laboratories	630#

#May include:	Sq. Ft.
(1) Office, conference, preparation, and storage areas for two instructors	294
(2) Special chemical storage area	126
(3) Advanced project (student laboratory) area and storage	210

Equipment, Facilities, Arrangement. See: (1) "Suggested Chemistry and Physics Areas—Secondary Schools Equipment Layouts," State Department of Education, School Plant Section; (2) "School Facilities for Science Instruction," National Science Teachers Association, 1961, Washington 6, D.C., Chemistry: pages 141-160.

Facilities unique to chemistry:

(1) The normal ventilation system must be supplemented with a manual control exhaust system for emergency ventilation to the outside.

Section

(2) At least one standard fume hood must be provided in any laboratory in which experiments produce toxic fumes and gases (Industrial Commission Code).

(3) The fume hood should be located and designed so as to serve as a demonstration or work area. It may be placed in the advanced project area separated from the classroom-laboratory by a vision panel. In some schools small downdraft hoods are used on the student laboratory tables, preventing crowding around a single hood.

(4) A still to provide "pure water", having a capacity of about one gallon per hour, is commonly mounted on a wall above a laboratory table; a shelf to support a five gallon receiving bottle should be provided. An ion exchange apparatus is used by some schools instead of a still.

(5) Eye hooks are desirable in the ceiling above the demonstration table and in the perimeter ceiling above the lab area.

(6) A work surface and storage for tri-beam balances, hand balances, and centrifuges should be provided. A work surface 10′ long and 36″ high may be provided in the laboratory area, with top of the same material as demonstration desk and with overhang, no holes in the top and free from obstruction, locked cupboard above and drawer space below.

(7) Chemical storage should be designed with special ventilation, should be fire resistive, and separate from storage space for apparatus and other supplies.

(8) For safety, provide an overhead shower where dangerous chemicals are stored, and an eye wash facility in or adjacent to the preparation room. Provide fire blanket, carbon dioxide fire extinguisher, first aid kit. Any radioactive materials should be stored in containers certified as safe by a recognized approving authority. Safety cabinets are available providing most of the above features. Such a cabinet should be located so as to be convenient to both pupils and instructors when needed.

75.24 Physics

Size. Suggested floor area (approximate) for a 28 pupil classroom-laboratory:

	Sq. Ft.
Classroom-laboratory: 28 pupils @ 52½ sq. ft. per pupil	1470
Auxiliary facilities: to serve two classroom-laboratories	630#

#May include:	Sq. Ft.
(1) Office, conference, preparation, and storage areas for two instructors	420
(2) Advanced project area (student laboratory) and storage	210

Equipment, Facilities, Arrangement. See "Suggested Chemistry and Physics Areas—Secondary Schools Equipment Layout," State Department of Education, School Plant Section; (2) "School Facilities for Science Instruction," National Science Teachers Association, 1961, Washington, D.C., Physics: pages 161–182.

Facilities Unique to Physics:

(1) For physics alone, normal ventilation should be sufficient and an acid resisting floor would not be necessary.

Section

Where chemistry also is to be taught, the statements under chemistry apply.

(2) Eye hooks should be provided in the ceiling above the demonstration table and laboratory area.

(3) Physics laboratory tables that are movable are desirable for flexibility. Fixed service facilities may be located along perimeter walls or at islands in laboratory area.

(4) The table top of the demonstration unit and tops of laboratory tables should have 3″ overhang to permit clamping of devices to the top making the table tops completely free of holes and obstructions.

(5) The demonstration table may be equipped to install a TV camera which can view small instrument experiments and transmit the image to TV receivers mounted above the demonstration table.

(6) A conduit to the roof is desirable so that wire connections can be maintained to this outside area.

(7) As a desirable accessory space, a science shop where electrical and mechanical repairs can be made for the entire science department may be provided.

75.25 Multipurpose Classroom-Laboratory

Size. Suggested floor area (approximate) for a 28 pupil multipurpose classroom-laboratory for biology-chemistry-physics and auxiliary facilities.

	Sq. Ft.*
Classroom-laboratory: 28 pupils @ 45 sq. ft. per pupil	1260
Auxiliary facilities: to serve two science rooms	630#

#May include:	Sq. Ft.
(1) Office, conference, preparation and storage areas for two instructors	294
(2) Special chemical storage area	64
(3) Plant room, advanced project and storage areas	168
(4) Animal room area and storage	104

---

*Minimum areas. Multipurpose classroom-laboratory also suited for a general science 9—biology combination.

Equipment, Utilities, Arrangement. See "Multipurpose Science Facility—Chemistry, Physics, Biology—Suggested Layout for Space and Equipment," State Department of Education, School Plant Section. Also see "School Facilities for Science Instruction," National Science Teachers Association, 1961, Multipurpose Science Room: pages 71–94; and sections 75.22 Biology, 75.23 Chemistry, 75.24 Physics.

75.3 Auxiliary Facilities to Classroom-Laboratories. The following suggested areas, for the most part, serve two science rooms. For further detail see the SUGGESTED LAYOUTS, State Department of Education, School Plant Section referred to in sections 75.21 General Science, 75.22 Biology, 75.23 Chemistry, 75.24 Physics, and 75.25 Multipurpose Science Room.

(1) Storage. Where only one science laboratory is served, at least 125 square feet of storage should be provided. A storage room serving two science rooms should have a minimum of 150 square feet, with 180 or more desirable. A

Section

central storage and preparation room serving three or more laboratories may require 400–500 square feet. Banks of graduated drawers and suitable open shelving are typical of general storage. One section of a storage room used for chemical storage should be provided with overhead shower and 12″ shelving for dangerous chemicals; safety ledges in front and painted with acid resisting paint.

(2) Office-conference-preparation area. A combination of office, conference and preparation area is suggested, located adjacent to the storage area and with easy access to it. The office-conference area will provide space for desks and files for two instructors, clothing storage, conference space and reference shelving. The preparation area should be provided with laboratory counter, sink with hot and cold water, soap and towel dispensers, gas and electric outlets, and additional provisions suited to the types of laboratories served. A safety cabinet with an eye wash fountain should be provided if a chemistry lab is served. Locate safety cabinet in science room adjacent to preparation area, conveniently available to both instructor and pupils.

(3) Advanced project area. Space should be provided sufficient to enable 6–8 pupils to work on special projects and research. A light-proof folding door may divide the space into two project areas, one for each of two adjacent science rooms, each with counter, water, gas, electric outlets and sink, work table, and research library.

(4) Plant room. See Section 75.22 Biology.

(5) Animal room. See Section 75.22 Biology.

(6) Dark room. A preferred location for a dark room is in the materials production center or audio-visual unit. See sections covering. In case of remodeling an older building in which a dark room is not provided elsewhere, it may be located adjacent to the general science or physics room.

75.4 Furniture and Equipment

75.41 General. The types of furniture and equipment for the classroom, laboratory and accessory areas should be determined before working drawings are developed after consultation with the state science consultant and the school plant planning section.

75.42 Chalkboard and Tackboard. Not less than 20 lineal feet of chalkboard and 16 lineal feet of tackboard, at least 42″ high should be provided. The bottom of the chalkboard rail should be at least as high as the demonstration desk and counters (not less than 36″). Horizontal or vertical sliding or similar elaborate chalkboards are not sufficiently tested and proved to be recommended.

Chemistry and physics. Some science specialists recommend 20 lineal feet of chalkboard 48″ high behind the demonstration desk, and above the chalkboard a map-tack rail for hanging charts. Still another map-tack rail is provided at the wall-ceiling juncture for hanging charts 36″ high so that they can be seen by the pupils. About 12 lineal feet of tackboard is provided near the room entrance, and about 8 lineal feet of pegboard for mounting displays.

Section

75.43 Display. In addition to tackboard and pegboard, provide display cases in the room and hall. See State Department of Education Suggested Layouts.

75.5 Other Details

75.51 Plumbing. Provide:

(1) Water and gas connections for each laboratory area, each storage and preparation room, and each advanced projects room; all concealed waste lines acid resisting.

(2) Master disconnect for water and gas services to demonstration desk, laboratory and auxiliary rooms, at or near the demonstration desk, and easily accessible.

(3) Vacuum breakers (Minnesota Plumbing Code) on all laboratory table and counter water supply pipes equipped with serrated tips from which the water outlets can be extended below the spill line by means of a hose.

Note: About one-half of the goose neck water supply pipes may be equipped with plain (non-serrated) tips which do not require vacuum breakers.

75.52 Ventilation. The ventilation system should provide adequate air change for science room operations. For general science and physics rooms: 30 cfm per pupil with 7½ cfm outside air. For biology, chemistry and multipurpose science rooms: 8–10 air changes per hours, 100% outside air, 110% exhaust with manual switch control. This system supplements the normal ventilation system providing 30 cfm per pupil and 7½ cfm outside air. Chemistry and biology storage spaces require 24-hour special exhaust ventilation. At least one fume hood should be provided in science rooms in which chemistry is taught. See table 241.1 and Sections 252.2–252.3.

75.53 Electrical

a. Outlets. Provide properly located electrical outlets for type, location, and arrangement of laboratory and audio-visual equipment; waterproof outlets for plant and animal rooms.

b. Lighting. Provide 70 foot candles at work surfaces. See section 193.3 Table 2. Control artificial light in science rooms by dimmer switch at or near the demonstration desk.

75.54 Daylight Control. For description of daylight control devices permitting use of audio-visual equipment, see Section 196.2.

75.55 Sound Control. Provide acoustical planning of all science spaces. See Section 177.1 Table 1: "Sound Conditioning Needs." Provide exhaust fans of "silent" type.

75.56 Floors. Provide floors of a non-slippery type and of a material not affected by water and chemicals.

SECTION 76.0. MATHEMATICS LABORATORY

Section

76.1 GENERAL

a. There are unique phases in the modern approach to mathematics which have a place in every program: (1) the theoretical or pure mathematics, and (2) the practical or applied mathematics.

b. For theoretical or pure mathematics, it is essential to provide a LECTURE OR CLASSROOM AREA containing some or most of the following:

A common lecture-recitation area with pupils grouped about it
Lecture equipment, such as overhead projector, television and special aids
Ample chalkboard and display area
Mathematics library.

c. For practical or applied mathematics, it is important to provide for a LABORATORY AREA containing some or most of the following:

Teaching machines, including calculators (an electronic digital computer is ideal)
Special equipment for mathematical experiments and research projects
Pupil laboratory-study tables
Conference and seminar area (some individual pupil carrels).

School facilities for certain advanced mathematics classes will ultimately center around the electronic digital computer, but the need for a mathematics laboratory does not hinge on the availability of a computer. There are more than enough other devices, equipment, applications, and techniques unique in mathematics, that require laboratory facilities.

76.2 MATHEMATICS LABORATORIES

a. In some schools the mathematics laboratory is a room comparable in size to a conventional classroom in which group instruction is supplemented by individual activity requiring special equipment. In schools whose mathematics curriculum includes instruction in probability, statistics, and elementary numerical analysis, the laboratory may be a room in which pupils can become acquainted with the important field of digital computation and can learn to operate desk calculators, using them to solve problems that would be much too complicated to solve by paper and pencil calculations.

In such a laboratory, there must be good lighting, good acoustics, and sturdy work tables, at least 24" wide, equipped with a sufficient number of electrical outlets for plugging in the calculators. This electric service should be supplied regardless of whether or not the first calculators provided are manually operated, since they will be replaced eventually with electric machines.

b. In a few high schools, with many more predicted for the future, the mathematics laboratory is equipped not only with a number of desk calculators and other equipment, but also with a high-speed electronic digital computer, and instruction in high speed digital computation is available to the advanced students.

c. The GENERAL LAYOUT of the mathematics classroom-laboratory follows:

Main Classroom-Laboratory Area

LECTURE:
- Teacher's demonstration desk, lecturn, cart
- Overhead projector, screen, and ultimately television
- Ample chalkboard and display
- Pupil desk-chair units or tablet arms

LABORATORY:
- Pupil work tables in central area, each with electric service
- On perimeter (rear wall and some of side walls): counter and storage for teaching machines, calculator and other special equipment
- Computer (small unit connected with central computer) when the school can afford it.

Auxiliary Areas

Office, conference, and library area

Preparation and storage (if storage is not in laboratory)

Research and advanced project area. May be small seminar room or individual pupil carrels, or both.

Section

d. SIZE. Suggested floor area (approximate):

	Sq. Ft.
Classroom-laboratory: 25 pupils @45 sq. ft. . .	1125
Auxiliary facilities: to serve classroom-laboratory and adjacent conventional math classroom	550#

#May include:
(1) Office, library, pupil conference area
(2) Storage and preparation area
(3) Research and advanced project area, including some individual carrels.

NOTE: The design pattern for the mathematics classroom-laboratory is still experimental. School people planning such a facility should consult early in the preliminary planning phase with the State Consultant for Mathematics and the School Plant Planning Section, Department of Education.

SECTION 77.0 ART EDUCATION

Section

77.1 General

77.11 Program. Courses offered by secondary schools range from exploratory courses in the junior high school to continued general and specialized courses in the senior high school and in adult education programs.

77.12 Activities. Secondary schools seek to develop the interests, capabilities and aesthetic tastes of pupils by offering fine arts courses centered around:

(1) Two dimensional activities which may include: color and design, drawing and painting, illustration, figure drawing, lettering, art service activities—posters, banners, printing production, interior decoration.

(2) Three dimensional activities, such as: ceramics, sculpture, construction of models, jewelry and enameling, plastics, art metal, textile printing, and stagecraft.

77.2 Number of Teaching Stations. Small classes with individual instruction and informal environment are necessary. Class size of 20 pupils is desirable with 24 a desirable maximum class size. To calculate the number of teaching stations the following formula may be used:

$$\text{*Art Laboratories} = \frac{\text{Subject Enrollment}}{\text{Class Size x (Periods per day—1)}}$$

---

*If art taught less than 5 days a week, use general formula:

$$\text{Art Laboratories} = \frac{\text{Subject Enrollment x Periods per Week in Subject}}{\text{Class Size x Periods Room Available per Week}}$$

77.3 Location. The art department should be located on the first floor for easy transfer of materials and exhibits. Natural light of an even quality such as north lighting is desirable. It may form a fine arts center with the music and drama departments. Proximity to the multi-use auditorium stage, the industrial arts and home economics departments is desirable.

77.4 Facilities

77.41 Internal Traffic. In planning the art room, special provision should be made for mobility and flexibility in the use of equipment and for making a variety of materials quickly and systematically available. Work centers and their equipment should be carefully planned with appropriate traffic lanes between them.

77.42 Elements. Depending upon the type of program and the size of the pupil and community groups to be served, art facilities will be contained in one room or in one room plus related facility spaces. The art room or department should contain the following elements:

a. Planning and demonstration area. Equipped with instructor's desk, file and work table, adjacent to instructor's storage area, and mounted projection screen for audio-visual presentations.

b. Pupil instruction area. Equipped with single or 4-student art tables, arranged for viewing demonstration area, chalkboard, and projection screen.

Section

c. Work centers. Provide appropriate work centers for fine arts and selected arts and crafts with appropriate tools and equipment. Include:

(1) In the open areas of the art room: such movable work surfaces as art tables or easels and stools, art horses, wood working bench, ceramic bench, potters wheel, model stands.

(2) On selected perimeter walls: work centers for such arts and crafts as clay modeling, ceramics, metal craft and jewelry, and others. Equipment may include: work counters with wash and work sinks, electric outlets, drying racks, clay cart, kiln; vented spray booth unit; art metal craft counter with vises; saws and buffers; tool panels; and a variety of small crafts tools.

Note: See suggested layout for Art Education Unit obtainable upon request from the School Plant Planning Section, State Department of Education.

d. Storage. Storage for the equipment and materials peculiar to the area should be provided along perimeter walls in cabinets above and below counters, in open wall shelving, in movable units, and should be supplemented by storage in auxiliary spaces off one end of the main art room. Teacher storage and pupil supply areas should be lockable. Consider:

(1) Built-in cabinets for each class group containing tote trays, a section to accommodate drawing boards, and a flat storage area for large drawings. Paper storage units should be 28" deep or more.

(2) Smock or apron storage cabinet with ventilation screens and hanging hooks.

(3) Ventilated storage below the sink units for cleaning materials, mixing containers and sponges.

(4) Fixed or portable wall panels for special tools for each area.

(5) Individually locked drawers or units for storage of jewelry, leathercraft or other expensive work and tools.

(6) Bulk storage space, equipped with 12", 18" and 24" deep adjustable shelves for storage of paints, papers, dry clay, cloth, carving wood, metal and other supplies for crafts and three dimension materials.

(7) Space for partially completed projects, in the art room or auxiliary area. Grooved racks into which masonite or aluminum trays containing wet work may slide are suggested. Open racks at the top of base shelving or cabinets will permit the vertical storage and drying of oil paintings of various sizes.

(8) Some table height base cabinets so planned that they can be wheeled as complete work units for clay, block printing, plastic construction, painting or carving to any part of the room.

e. Washing and sink area. See Section 77.61 following.

f. Chalkboard and display

(1) A chalkboard at least 12 feet in length should be located behind the instructor's planning and demonstration area.

(2) Tackboard and pegboard for display of two dimensional art work should be placed on sections of walls not covered by wall cabinets, tool panels or chalkboard. Doors of wall cabinets may be covered with tackboard or tackboard strips for additional display surfaces.

(3) Extra deep display cases should be built as part of the wall separating the classroom from the corridor, with adjustable shelves, an electric outlet, and tackable sides and back. Other display cases for exhibiting pupils' work should be provided in public areas.

77.5 Size. Gross floor areas recommended:

Class Size		Approximate Floor Area	Auxiliary Area
20 pupils	. . . .	1050 sq. ft.	250 sq. ft.
*24 pupils	. . . .	1300 sq. ft.	250 sq. ft.

*A laboratory unit and auxiliary space for 24 pupils provides about 1300 square feet for the art laboratory and about 250 square feet of auxiliary space for: (1) instructor's storage, (2) kiln, and (3) student project area. See layout: "Suggested Art Education Facilities," obtainable upon request from State Department of Education, School Plant Section.

77.6 Utility Services

77.61 Plumbing

a. Water. Hot and cold water are desirable for such activities as painting, papier-mache, clay and plaster work, and for general clean-up.

b. Sink. A sink with four or more mixing faucets, of acid resistant material and acid resistant waste lines, should be provided so that several pupils can work or wash at the same time. A peninsular unit with 2 sinks will permit students to work on two or three sides. See School Plant Planning Section suggested layout referred to in 77.42. Sinks should be equipped with removable basket type strainer having drain stop feature and, in addition with plaster traps. When possible, provide separate water outlet for clay work area.

77.62 Electrical

a. Outlets for 110 volt electrical service, spaced 6 to 8 feet apart, over work area counters on selected perimeter walls and duplex outlets on other walls at about a 40-inch height are necessary for equipment such as an air brush, small power tools, spotlights, miniature stage equipment, displays and projection equipment.

Water-tight 110 volt service outlet boxes, installed flush with the floor on a center line of the room, permit use of equipment in the central area without dangerous extension cords.

b. A kiln with a firing chamber of about 1,000 cubic inches with thermostatic control may be provided. This generally will require 220 volts. Install kiln at least 20 feet from spray booth unit.

c. Permanently installed electric power equipment, especially kilns, should be on separate lines controlled by individually locked switches or from a central pilot light switch panel equipped with a lockable door.

77.63 Gas Service. Gas outlets for jewelry blowtorches, with master control valve, are needed every 30 inches along the metal craft counter or bench. An outlet for a compressed air torch to be used in a remote section of the room is suggested for larger soldering and annealing work. If a gas fired kiln is provided, a master cut-off valve is required. This area should have a table top of fire resistive material as a safety protection.

77.7 Other Detail

77.71 Ventilation. The spray booth unit (about 24" x 24" x height varies) requires mechanical exhaust ventilation. See Sections 134.6, 252.2 and 252.5.

77.72 Acoustics. The room should be acoustically treated to reduce the noise of crafts works and to minimize the interference of one group with another as the class carries on many activities.

77.73 Lighting. Natural light of an even quality such as north lighting is desirable. Artificial lighting of at least 70–75 foot candles should be provided. Lighting specialists have recently recommended 100–120 foot candles. Shadows and glare should be reduced to a minimum in all parts of the room. Lighting which approximates the color of daylight will permit accuracy of color work regardless of changing outdoor conditions. Special equipment may require additional illumination.

77.74 Floors. Flooring of subdued color tones is recommended, resistant to water, cleaning solvents, oil, etc. Light colored rubber asphalt, vinyl asbestos or vinyl tile are all light reflecting and easily maintained. Maple, if well finished, does not absorb odors or stains readily. Treated concrete floors may be best for welding areas and rooms in which there is heavy duty use of clay.

SECTION 78.0 THE MUSIC UNIT

78.1 PROGRAM

78.11 General. Appreciation of music as an art and the attainment of its many objectives, including the development of permanent interests, aptitudes, and talents, through participation by pupils in musical activities, underlie the music program at all levels. Therefore, it becomes necessary, even in smaller schools, to plan specific areas to accommodate appropriately music activities.

78.12 Activities. These may include:

a. INSTRUMENTAL: Concert band; orchestra, string orchestra; marching band.

b. VOCAL: Chorus; choir; girl's glee club; boy's glee club.

c. SMALL GROUPS: Instrumental ensemble; vocal ensemble; solo.

d. CLASSROOM: Music appreciation; music theory.

78.13 Facilities to Accommodate Activities

Major Facilities	Auxiliary Facilities or Areas
Instrument rehearsal room	Practice rooms
Vocal rehearsal room	Instrument storage room or area
Music classroom	Robe and uniform storage room or area
For small school:	
All purpose general music room	Music library room
	Instrument repair room
	Instructor's office(s)
	Auxiliary rehearsal room
	Recording room

Music rooms and auxiliary facilities should be provided as a suite in all schools and in combinations to suit local programs.

78.14 Number of Teaching Stations

a. ELEMENTARY SCHOOLS. In elementary schools, most of the vocal program is provided in the self-contained classroom under the teacher or music supervisor. Some time should be available in the assembly room or auditorium for large group rehearsals. In elementary schools with two or more classrooms per grade, a separate instrumental rehearsal or auxiliary instruction room should be provided, large enough to accommodate the largest instrumental group anticipated and with necessary storage space.

b. SECONDARY SCHOOLS

(1) A one-teacher program will need a general music room for both instrumental and vocal music, with essential auxiliary areas provided in the room or adjacent to it.

(2) Where two or more full-time teacher programs exist or are planned, specialized rooms should be provided: an adequate sized instrumental rehearsal room, a vocal room, music classroom, and auxiliary rooms suited to the local program and size of school.

78.15 Location. In the initial planning of the school building, the following factors should be given major consideration for the music department.

a. The music unit should be located adjacent to or in the area of the auditorium or gym stage, or only separated by a corridor; on the same level as the stage or with ramped access to it.

b. The department should be usable as a unit independent of the rest of the building, with locking doors to control circulation.

c. It should be convenient to the athletic field for coordinating field activities.

d. The music department should be compact and self-contained with all rooms arranged to form an easily managed unit.

e. Effective isolation and insulation should be provided to eliminate sound transmission to other instructional areas and to insure the segregation of the music unit from other sources of sound.

78.2 MUSIC ROOMS

78.21 Instrument Rehearsal Room (Band and/or Orchestra). The instrument rehearsal room is the basic center in the music department and special rooms and auxiliary areas should be planned to extend its usefulness. See 78.3.

a. SIZE. Room size is usually determined by the number of pupils in the largest instrumental group scheduled. Bands or orchestras may range from 60 to 90 members or more.

Number of Members	Per Member Square Feet	Floor Area Square Feet
60–70	24–22	1440–1540
70–90	22–20	1540–1800

Ceiling height should be 12′ to 14′. Shape of the room may be a ratio of approximately 3 to 2. The acoustical environment is enhanced by angling one or more walls to provide non-parallel wall surfaces.

b. RISERS. Risers should be 6″ to 8″ high and from 54″ to 60″ wide. The top riser should be 66″ to 72″ wide for larger instruments. The risers should be curved or angled so as to form a full semi-circle around the instructor's podium as a center, with the first riser about 7′ from the podium. Space should be provided in front of the risers for podium, piano, audio-visual and recording equipment, chalkboard, and desired cabinet storage.

78.22 Vocal Rehearsal Room. This room is designed for group vocal music.

a. SIZE. This room, exclusive of storage, should be designed to accommodate the largest vocal group scheduled. Choral groups range from 60 to 100 members or more in schools large enough for specialized facilities. Suggested floor areas:

Number of Members	Per Member Square Feet	Floor Area Square Feet
60–80	18–16	1080–1280
80–100	16–14	1280–1400

Ceiling height should be 12′ to 14′. Shape of the room may be a ratio of approximately 3 to 2. The acoustical environment is enhanced by angling one or more walls to provide non-parallel wall surfaces.

b. Risers. Floors should be stepped up to not less than three semi-circular risers, 6″ to 8″ high and 36″ to 48″ wide. Treads should face the long axis of the room. Risers need not form a full semi-circle as for risers in the instrumental room. Space should be provided in front of the risers for podium, piano, audio-visual and recording equipment, chalkboard and any desired cabinet storage.

78.23 All Purpose General Music Room. This room should combine the essential features of both the instrument room and the vocal room, with the needed auxiliary areas.

a. Size. The general music room should be as large as an adequate band room and should also accommodate the largest anticipated choral group. Suggested size: (based on largest anticipated band group)

Number of Members	Per Member Square Feet	Floor Area Square Feet
50–60	24	1200–1440
60–70	24–22	1440–1540

Such space would adequately provide for 50 to 70 instrumentalists or a vocal group of 80–100 pupils.

b. Risers and Other Features. The shape of the room, height of ceiling, risers, space in front of risers, should be provided generally as indicated in sections 78.21 and 78.22. It may have auxiliary facilities for practice, storage of instruments, robes and uniforms, music library and office, and in small schools may serve classes in music theory and appreciation.

78.24 Music Classroom. Music theory and appreciation classes necessitate a classroom of adequate size for 25 to 30 pupils and piano. A general classroom properly modified for sound control will serve. The room if used entirely for music classes should be in the music unit. Other equipment will include music playing and recording machines, music cabinet, desk, chalkboard with an 8′ section scored to include a staff and staves.

78.3 AUXILIARY ROOMS

78.31 Practice Rooms

a. General. Practice rooms should be: (1) built in a suite arrangement near the main rehearsal rooms, (2) acoustically treated and insulated against sound transmission, (3) ventilated, and (4) provided with double glazed observation windows in each door.

b. Size and Number. Suggested sizes are: 6′ x 8′ (minimum) for band orchestra instruments; 8′ x 10′ for piano and one other instrument: and 10′ x 12′ for small ensemble. Schools with anticipated enrollments of 300–600 pupils should have at least two practice rooms; enrollments approaching 900 pupils at least three practice rooms; and enrollments approaching 1200 or more pupils at least four practice rooms.

78.32 Instrument Storage. Storage for instruments should be provided adjacent to the band room. An arrangement of cabinets on a wall of the band room may suffice for some installations, but a storage room is preferable for large departments.

If cabinets are built into the band room, additional space should be provided. Cabinets for large instruments may advantageously be placed on the rear of the room and should be about 4′ deep and 6′ high. Many of the smaller instruments can be kept in student type lockers. Separate locking should be provided for each instrument compartment. Doors permitting inspection and ventilation are recommended.

a. Storage Room. The instrument storage room should be: (1) located to open off the instrument rehearsal room, (2) provided with double doors without mullions at either end to facilitate free one-way passage of traffic and moving of large instruments and, (3) designed to protect instruments against excessive heat, moisture, and changes in temperature.

b. Size. Storage room should not be less than 250–300 square feet for smaller instrumental groups not exceeding 60 members. Bands approaching 100 members will need a storage room of at least 450 square feet with 3 sq. ft. additional space for each additional member.

78.33 Instrument Repair. Facilities for minor repair of instruments will be necessary. They consist of a workbench, sink, tool cabinets and a cabinet for parts and supplies. Facilities may be in a separate room adjacent to the instrument storage room, or may be in the director's office, the music library, or storage room.

78.34 Uniform and Robe Storage. Space for storing school owned uniforms and choral group robes is necessary. Storage should be equipped with spaced hanging poles and compartments for accessories. Wardrobe closets or cabinets may be used for this storage. Storage wardrobes or cabinets should be ventilated. Where no separate storage room is provided a space for uniform and robe storage may be located in the instrument storage room. Proximity of convenient and separate spaces for boys and girls to change clothes should be given consideration. Ensemble rooms may be located so as to serve this purpose.

78.35 Music Library. This room should: (1) adjoin the instrument storage room, (2) open off the instrument rehearsal room, and (3) have a minimum area of 200 sq. ft. to accommodate a desk, table, chairs, four drawer legal file, music sorting racks, machine equipment cabinet, and supply cabinet. The space is frequently combined with the director's office.

78.36 Director's Office. This room should be located so that supervision of rehearsal and practice rooms can be conveniently carried out. It should have space for a desk and chair for each instructor, filing cabinets, storage cabinets, and any special electronic equipment. In some schools the office area, music storage area, music library area and instrument repair area are consolidated in one space dimensioned for the purpose.

Section

78.37 Auxiliary Rehearsal Room. In large schools that have several bands, orchestras and choruses, a room where a complete section of a vocal or instrumental organization may rehearse while the large rehearsal rooms are in use is essential. The room can double as a dressing room for band members. This room should be: (1) located next to large rehearsal room, (2) about ⅓ the size of the large rehearsal room with a level floor, (3) acoustically treated and sound insulated, (4) equipped with chalkboard and pen board space.

78.38 Recording Room. This room is desirable. It should be located off the front of the main rehearsal room, house the recording and playback equipment, and have connecting microphone and speaker outlets to the main rehearsal room. A window should face into the main rehearsal room.

78.39 Special Equipment. For detailed recommendations concerning instrument lockers, music storage and sorting racks, storage cabinets, portable and collapsible risers, work benches, tools, acoustics—See "MUSIC—Buildings, Rooms, and Equipment" published by the Music Educators National Conference (NEA) 1201 Sixteenth St. N.W., Washington 6, D.C.

78.4 COMBINATIONS. When music facilities are combined temporarily with such spaces as lunchrooms, auditoriums and the like, provision must be made for: (1) acoustical treatment of walls and ceilings, (2) insulation or location to prevent sound transmission to and from other spaces, (3) safe and convenient storage for musical instruments, including the piano, (4) chalkboard and display (tackboard, tack strip and map rail), (5) electrical outlets for audio-visual and electrically operated instruments, (6) space for practice rooms, robe and uniform storage, music library, music storage—as indicated in previous sections. Such combinations are seldom advisable—usually impracticable.

78.5 OTHER CONSIDERATIONS

78.51 General. Provide: (approximate amounts)

Item	Instrument Room	Vocal Room	Music Classroom
Chalkboard*	16 lineal ft.	16 lineal ft.	16–20 lineal ft.
Tackboard	12 lineal ft.	12 lineal ft.	20 lineal ft.
Map rail and tack strip	Provide	Provide	Provide
Bookcase	—	—	13 lineal ft. of shelving (min.)
Teacher's closet, shelving	—	—	Same as general classroom

---

*On wall or surface facing the seated pupils. It is essential that some chalkboard be provided, even if portable.

Section

An 8′ section of chalkboard should be scored (staff and music staves) in each of the music rehearsal rooms and music classroom.

78.52 Plumbing. There should be provided: (1) a work sink in the instrument repair room or area, (2) drinking fountain convenient to band and vocal rehearsal rooms, and (3) toilet rooms convenient to music suite for use during out-of-school hours.

78.53 Heating and Ventilation. Provide zoning of heating, ventilating and cooling services so that music facilities can be used at other than regular school hours, including the summer months.

78.54 Acoustics. Give consideration to:

a. Proper acoustical treatment of music rooms for noise reduction.

b. Moderate wall splaying (slanting away from rectangular) toward eliminating flutter, echoes, and improving diffusion.

c. Provisions for sound control such as insulated partitions, use of double glazed windows and doors, lining of ventilation ducts with sound absorbent materials, providing sound locks between music rooms and between the rest of the building and music rooms.

REFERENCES. See Sections 170–179 SOUND CONTROL (178.2 Music Department Acoustics). For more detailed discussion of MUSIC ROOMS see "MUSIC—Buildings, Rooms, Equipment" Music Educators National Conference (NEA) Washington 6, D.C., pages 32–44.

78.55 Fenestration. Provide limited fenestration, if any, in the music suite.

78.56 Audio-Visual. Where there is fenestration, provide blackout facilities as needed in each main instrumental and vocal rehearsal room, and in each music classroom. See Section 196.2.

SECTION 79.0 INDUSTRIAL ARTS EDUCATION

Section

79.1 Scope. Industrial arts is an integral phase of general education involving a study and development through shop and related class work of vocational interests, consumer knowledge, and manipulative skills. It serves also as a basis for guidance leading into vocational training. As general education it is to be distinguished from Trade and Industrial Education which provides job training. Provision for industrial arts should take into consideration the services to be rendered by the industrial arts department to community life and the adult education program.

79.11 Program

a. Junior Secondary School. The industrial arts program in grades 7–9 offers exploratory experiences in a variety of areas: wood, metal, electronics, plastics, drawing, leather, graphic arts, home mechanics, etc.

b. Senior Secondary School. In grades 10–12, each pupil is provided opportunity:

(1) To further generalize his industrial arts experiences in advanced courses, such as general metal, general woodwork, general drawing; or

(2) To specialize his training within specific areas, looking ahead to occupational employment, in such areas as:

- Architectural drawing
- Aeronautics
- Auto mechanics
- Carpentry
- Construction wiring
- Electrical wiring
- Foundry
- Machine drawing
- Motor rebuilding and repair
- Electronics
- Pattern making
- Printing
- Sheetmetal
- Welding

79.12 Relation to Size of School

a. Secondary schools enrolling 100–150 boys will usually be one-shop schools. A comprehensive GENERAL SHOP will provide for all industrial arts activities, grades 7–12, in one large room, equipped for this purpose, under one teacher.

b. Secondary schools enrolling 150–300 boys will usually be two-shop schools, providing two general shops and a classroom, or in some school districts, an agriculture farm shop, classroom, and a basic general shop.

c. Secondary schools enrolling over 300 boys provide basic general shops at the junior secondary school level and suitable UNIT SHOPS and classrooms at the senior secondary level.

NOTE: A unit shop is a shop in which one area of work is taught such as "auto mechanics", covering many phases of study, and involving specialized equipment and machines common to the field. Some programs requiring specific unit shop facilities are listed in Section 79.11 b. (2).

79.2 Teaching Stations

79.21 Definition. One teaching station is defined as a shop space, with auxiliary facilities, including a related classroom or planning area, that is occupied by one class (at a time). Some of the auxiliary facilities may be shared with other similar teaching stations.

Section

79.22 Number of Teaching Stations. The number of teaching stations necessary to accommodate the enrollment in industrial arts may be found from the following formula:

$$\text{Teaching Stations} = \frac{\text{No. of Pupils enrolled in Industrial Arts}}{\text{Class size x No. of periods per day available}}$$

The number of teaching stations may be affected by the need to offer a broader program than may be done in space arrived at on a pupil basis. Local conditions in the school and the extent of planned adult education should be closely studied so as to provide the most needed facilities.

79.23 Types of Teaching Stations. These include: (1) the comprehensive General Shop, (2) the Unit Shop, and (3) the Drawing or Drafting Room.

79.3 Location. Industrial arts shops should be located in a wing of the building, on the ground floor, with the noisiest shops placed farthest from the academic areas. Provide for future expansion. Non-bearing partitions within the shop area permit greater flexibility in future expansion or remodeling. Provide an outside access for delivery of bulky equipment and supplies. Provide a means of isolating the shop area from the rest of the building and an outside door to the area for evening, weekend, or summer classes.

79.4 Facilities. The industrial arts shops should have: sufficient pupil work stations for the class; sufficient manual and power tools for the field or fields; a planning center or related classroom; instructor's office; storage; and such other auxiliary areas as necessary for the program. It is usually economical to combine the instructor's office and planning center in a one-man General Shop or in shops in a Two or Three Instructor Department. Large schools with four or more instructors may provide departmental offices and a separate pupil planning center. See Sections 134.1–134.81 "Hazardous Areas."

79.5 Shops

79.51 Shape. Shop should be rectangular for best teaching situation; ratio: 1 : 1½ or 1 : 2. This applies also to auxiliary areas.

79.52 Space Allotment. The size of industrial arts shops is determined by the equipment provided and the necessary space for work and safety around it. The size should be decided ultimately by study of equipment layouts. However, a size for preliminary designing purposes may be estimated, allowing 75 to 100 sq. ft. per pupil work station.

a. GENERAL SHOPS, WOOD SHOPS, AND MACHINE SHOPS should have a minimum of 1800 sq. ft. of working area for 24 pupil work stations, with 2400 sq. ft. desirable. Class sizes above 24 would necessitate larger areas.

b. ELECTRONIC SHOPS and other shops requiring less activity, require less space, but should never be less than 1500 sq. ft.

c. DRAFTING OR DRAWING ROOMS should provide a minimum of 1000 sq. ft. of floor space for 24 pupils and 1500 sq. ft. for 30 pupils (50 sq. ft. per pupil, minimum). Sixty sq. ft. per pupil is desirable.

Section

d. If a RELATED CLASSROOM AREA is provided, it should be at least 700 sq. ft. with vision panel in front to permit easy supervision by the instructor. Book cases, magazine racks, visual aid equipment, and the other features of a general classroom should be provided.

79.53 Auxiliary Areas. These include: Instructor's office area; planning area; materials and project storage centers; and other areas related to the type of shop, such as finishing room, tool center, etc.

a. GENERAL SHOPS. Provide the following auxiliary rooms, adjacent to and with access from the shop area:

Instructor-Pupil Planning Area: providing instructor's desk, file storage case, wardrobe; planning area with reference shelving, adequate for about five pupils; vision panel to shop area.

Materials Storage Room: providing materials storage for the various courses.

Finishing Room: containing paint spray booth, bench counter with sink; finishing bench with paint cabinets above. See Sec. 134.0 "Hazardous Areas."

b. THREE OR FOUR MAN DEPARTMENT. May provide:

Related Classroom-Planning Center: available to all shops; 700–800 sq. ft.; may be divisible for small group work.

Departmental Office-Work Center: about 50 sq. ft. for each instructor; partition panels; about 75 sq. ft. for lavatory.

Auxiliary Rooms: suited to each individual shop program.

79.54 Materials Storage. Desirable features:

a. Use all available space. Consider wall lockers and tool panels; tool center; storage space under work benches.

b. A tool room (90–100 sq. ft.) should be provided for shops requiring many small or expensive tools, such as a metal and power mechanics shop. If tool panels are to be used, the style and type will dictate the number needed. About 75 to 125 sq. ft. of panel are needed in most shops.

c. Lumber storage racks should be provided for storage of 14 to 16 foot lumber. Allocate space about 16′ long and 4′ wide. For short pieces of lumber, space needed varies, but minimum would be 2′ x 3′. Provision must be made for flat storage of plywood.

d. Provide a space about 2′ x 3′ in the finishing room for storage of finishing supplies. Provide metal finishing cabinets.

e. Sheet metal stock requires 3′ x 8′ storage. Dimensional stock storage should have a space 2′ x 12′.

f. Shops requiring small parts storage should reserve a space of about 2′ x 9′ for cabinets.

g. For drafting rooms, storage space is determined by types of drafting benches, plans for storage of paper and supplies, equipment, and reference materials.

79.55 Project Storage. Some project storage can be handled by lockers, placed either under work benches or against the wall. Such lockers may be 12″ x 12″ x 24″ or 12″ x 15″ x 21″ to accommodate small projects. Some large lockers or cabinets should be provided for large projects. Balcony storage of projects is possible if shop ceiling heights permit. A project storage room is desirable.

Section

79.56 Finishing Rooms. A finishing room should be provided in each general shop and in other shops when the program indicates. An area of at least 180 sq. ft. is needed for a finishing room in a wood shop and at least 120 sq. ft. in a metal shop. The finishing room should be equipped with exhaust fan, electric fixtures and of construction meeting the requirements of the State Industrial Commission and the State Fire Marshal. See SUGGESTED LAYOUT-FINISHING ROOM, available upon request from the State School Building Planning Section. See Section 134.5.

79.57 Display Case. An adequate display case should be provided in the corridor, preferably opening into an auxiliary room for servicing.

76.6 EQUIPMENT ARRANGEMENT. The arrangement of equipment, machines, and work stations should be determined by consideration of flexibility, safety, work procedures, flow of materials, and instructional efficiency. Desirable features:

(1) Main travel aisles should be 4 feet in width and secondary aisles at least 30 inches wide.

(2) Hazardous machines should be away from main aisles.

(3) Machines should be placed in sequential order for normal operation.

(4) Operators should not be in traffic aisles when operating machinery.

(5) Instructor should have clear vision over all work areas in the shop.

(6) Benches must be placed at least 4 feet apart to provide free work space.

(7) Lathes must be at least 30 inches apart and preferably 36 inches.

(8) Saws, planers, and jointers require from 12 to 16 feet front and back clearance.

(9) Cutoff, band, and radial arm saws require from 12 to 16 feet side clearance.

(10) Hot metal and welding areas need special treatment to provide protection for students and building. See Fire Marshal's regulations, Section 134.0 "Hazardous Areas."

(11) Keep noisy machinery or machinery which tends to vibrate away from pipes, ventilators, or supporting columns. These transmit noise to upper floors and other rooms.

(12) Treat areas around machines with non-skid preparation. Outline danger areas with painted lines.

(13) Equipment layout consideration must also provide for guard devices. All machines, belts, pulleys must be properly guarded at all times. Operation guards must be provided for saws, jointers, planers and other high speed machinery.

(14) Place fire extinguishers near danger areas, but not so close that an emergency requiring their use will cut off

access to them. Provide fire-proof containers for inflammable materials such as oily wastes and rags. Keep acetylene cylinders where they will not be affected by heat. Generation of acetylene gas in the shop is not recommended.

79.7 Construction Details

79.71 Floors. The following list suggests floor treatment, in order of preference:

a. General shop: maple, vert-grain Douglas fir, end-grain wood block, concrete.

Note: Hot metal area requires concrete.

b. Woodworking: maple, vert-grain Douglas fir, end-grain wood block, concrete with asphalt tile, concrete.

c. General metal: concrete or end-grain wood block.

d. Mechanical drawing: maple, vert-grain Douglas fir, asphalt or vinyl or rubber tile.

e. Electronics: same as "d.".

f. Crafts: same as "d.".

g. General classrooms and offices: asphalt or vinyl tile.

79.72 Walls. Recommended: dull-glazed brick or tile up five feet from the floor; upper walls and ceiling plastered. Ordinary plastered walls, light weight block, or brick walls are acceptable.

79.73 Partitions. Should be non-bearing curtain walls free from mechanical and utility building services. Upper part of partition between shop and office-planning area should be vision glass. Partition should be as sound-proof as possible.

79.74 Windows. Aluminum or steel windows with ventilation sash are desirable. Reduce glass area to minimum. See Section 197.1. Windows should be 4'-6" to 5'-6" from the floor for wall space utilization below.

79.75 Doors. Provide a double door with removable mullion to outside, located at least 6' from corner of shop. Provide overhead door for auto shop. Corridor door should be metal clad, glazed upper panels and located for best wall space utilization.

79.76 Chalkboard and Bulletin Board. Provide a minimum of 12 lineal feet of chalkboard per classroom or instructional area, at least 3½ feet wide.

Provide at least 24 square feet of bulletin board of same height as chalkboard.

79.8 Mechanical, Electrical and Other Services

79.81 Heating and Ventilation

a. Shop Area. See Table 241.1 Heating and Ventilating Conditions.

b. Related Classroom. See Table 241.1 Heating and Ventilating Conditions.

c. Exhaust Systems

(1) Automotive shops should provide overhead or under-floor ducts connected to a forced draft system to remove exhaust fumes. Main ducts should be a minimum of 8 inches in diameter and branch lines a minimum of six inches.*

(2) Finishing rooms should have a vapor proof ventilating system with an air movement of about 200 CFM.*

(3) Machines producing wood and grinding dust present a problem. Two systems of dust collection are commonly used. It is recommended that a stationary collector with permanent duct work be installed to each machine and that overhead ducts be used. Care should be exercised to insure a quiet operating system. The other method employs portable units which can be moved and attached to machines when needed.

Note: Dust collecting equipment should be placed outside the shop and unattached to the building.

79.82 Plumbing Services

a. Fountain and Wash Facilities. A drinking fountain should be provided separate from the wash facilities. Wash facilities which accommodate six or seven pupils simultaneously should be provided in the shop, located in the area of but not too close, to the entrance door.

b. Toilet Facilities should be provided adjacent to and within 100 feet of the shop area.

c. Gas. Gas outlets to fit equipment should be provided: bench outlets, ½ inch; forges and furnaces 1 inch; all with primary shut-off valves and under a master shut-off control valve.

Gas service needs will vary with programs. The following figures are offered as a guide only. The correct needs should be determined by the architect:

General Shop	100,000 BTU/hr to 150,000
Metal Shop	500,000 BTU/hr to 1,250,000
Machine Shop	100,000 BTU/hr to 850,000

79.83 Electrical Services

a. Electrical specifications and power installations must conform with standards of the National Electric Code. Check with local and State Board of Electricity requirements to assure compliance.

b. Shop power electric service for equipment should be either overhead or wall. Only the circular saw requires floor electric service.

c. Grounding connections must be made on all motors and power equipment, including portable electric tools.

d. Electric power should be controlled from a master control panel so that the instructor can shut down all power circuits in the shop in case of emergency as well as shut off and lock all power service when the shop is not in service. Provide pilot light and locate near the instructor's desk or office.

---

*See:
Exhaust Systems, Section 252.1
Local Mechanical Exhausts, Section 252.2
Paint Spray Booths, Section 252.5
Garages, Section 252.6
Hoods, Shop: Forge, Welding, Soldering, Section 252.7.

Section

e. Locate power strips on the wall above bench height but not so high that the use of the wall is impaired for other purposes.

f. Three phase operation is desirable on all motors over ½ horsepower.

g. Provide for added circuits for both 110/208 or 115/220 Volts.

h. Horsepower requirements for shops will vary with programs. The following suggestions are offered as a guide only:

	Three Phase	Single Phase
Woodshop	20 hp.	7 hp.
Machine Shop	33 hp.	5 hp.
General Metals Shop	10 hp.	5 hp.
Auto Shop	10 hp.	8 hp.
Electric Shop	varies	varies

i. Consider the necessary 3 way switches.

Section

79.84 Compressed Air. Air compressors should provide 60 pounds per square inch at the spray booth and 15 psi in other areas. A central unit with necessary piping and valves is recommended.

79.85 Visual Comfort. Artificial lighting should yield a minimum of 50 foot candles on the work at bench height; 75–100 foot candles for drawing; local lighting of 100–150 foot candles on machines where precision work is performed.

79.86 Sound Control. Shop activities create noise that interferes with instruction. Provide acoustical treatment for noise reduction in shop areas and for reverberation time in drafting rooms.

79.87 Painting Schedule. Should reflect good industrial practice.

79.9 SUGGESTED LAYOUTS. The School Building Planning Section and the Vocational Education Section, State Department of Education, will continue to develop "Suggested Layouts" for the various kinds and types of industrial arts shops. These layouts are available upon request.

SECTION 80.0 TRADE AND INDUSTRIAL EDUCATION

Section

80.1 Scope. A major function of Trade and Industrial Education is to provide students with basic skills, technical knowledge, and related industrial information in preparation for employment in a specific field of work. A study of local conditions may indicate that it is desirable to offer the program to both boys and girls.

Trade and industrial education classes are either day trade preparatory classes for youth and adults spending at least one-half a school day in learning a trade or trade extension classes for out-of-school youth who need pre-employment training, for apprentices and other learners who need related instruction, for journeymen and other industrial workers who need additional instruction, either related or supplemental, and most recently, for retraining industrial workers in area redevelopment programs. Extension classes include part-time classes, evening classes, and part-time cooperative classes.

Shop experiences involve both general and highly specialized industrial processes, as well as planning experiences, demonstrations, and conferences. These are supplemented by instruction in related subjects, such as shop mathematics, shop science, and shop safety. The shops and other facilities are used for instruction during the regular school day and for evening classes. Today, trade and industrial education programs are not only offered locally in secondary schools, but statewide in area vocational-technical schools.

80.2 Secondary School Programs. Two types of programs offered are Day Trades and Diversified Occupations (cooperative training). Day trade courses necessitate a shop or shops equipped with production machinery or equipment. Diversified occupation courses need only an office and classroom for the in-school part of the program, as training is accomplished by local part-time employment, under the supervision of a D. O. teacher-coordinator.

80.21 Courses. Some day trade and diversified occupation courses which may be offered include:

a. Auto mechanics
b. Cabinet making
c. Electrical wiring
d. Radio and Television
e. Electronics technology
f. Machine shop
g. Masonry
h. Carpentry
i. Plumbing
j. Sheet metal work
k. Tool and die
l. Refrigeration
m. Air conditioning
n. Welding
o. Steam fitting
p. Pattern making
q. Watch repairing
r. Printing
s. Commercial art
t. Plastering
u. Painting
and others.

Areas of work that are frequently included for girls include: cosmetology, practical nursing, tearoom operation, cafeteria operation, food preparation, sewing, tailoring, baking, and similar services.

The areas to be included in any particular school should be determined from a careful vocational survey of the community and area.

Section

80.22 Types of Teaching Stations

a. **The Unit Shop.** This is equipped for one field of training, such as sheet metal, machine shop or automobile mechanics. The shop or shops are used in the day trade program.

b. **The Diversified Occupations Classrooms and Office.** This is for the in-school phase of the diversified occupations program.

80.23 Number of Teaching Stations

a. **Day Trades.** Day trade classes spend three hours a day (15 hours a week) in the shop. Teaching stations may be determined from the following formula:

$$\text{No. of Shop Teaching Stations} = \frac{\text{Enrollment in Day Trade Course}}{\text{Class size x periods (3 hrs. each) that shop is available}}$$

Class size may vary from 10 to 20 but is preferably about 15 pupils. The length of the shop period (3 hours) permits scheduling only two periods a six hour day.

b. **Diversified Occupations Classrooms.** Class size may be 20 to 30 pupils. The number of D. O. classrrooms may be determined from the following formula:

$$\text{No. of D. O. Classrooms} = \frac{\text{Enrollment in D. O. Course}}{\text{Class size x periods classroom available}}$$

The classroom will be available not more than 3 hours in a 6 hour day schedule, since the D. O. coordinator and the pupils are scheduled to be away from school for a half-day, usually the afternoon. In the afternoon, the D. O. classroom may be used as a related classroom for shop classes or other subjects.

80.3 Planning Day Trade Facilities. The Trade and Industrial Education Unit of the State Department of Education offers its services in selecting the day trade courses to meet community or area needs and in determining the number and equipment of shops to provide for the program and enrollment.

80.31 Location. Day trade shops are preferably located in a part of the high school building or area vocational-technical school wing or building. All shops should have a ground level entrance with consideration given to the use of shop facilities during other than regular school hours. Related classrooms and diversified occupations classrooms should be adjacent to or near the shops.

80.32 Size of Shops. Day trade shop space and arrangements are developed similarly to industrial arts shops. The amount of space needed in these shops varies widely, depending upon the areas included, the type of equipment, and the number of pupil work stations. An architectural drafting room, for example, may require about 1000 square feet of floor area, an air frame-power mechanics shop up to 7200 square feet.

80.33 Arrangement and Auxiliary Spaces. Day trade shops should be provided with work stations and auxiliary areas similar to those in industrial arts shops, each suited to the particular areas included in the program.

Section

80.34 Layouts. The variety of courses available in the day trades program will necessitate designing the shop floor plan, equipment, and arrangement to suit the individual course. School officials and architects planning such facilities should consult with the State Supervisor of Trade and Industrial Education and the State School Building Planning Section in developing shop facilities for each project.

80.4 Diversified Occupations Classrooms and Office

80.41 D. O. Classroom. This room should have from 700 to 840 sq. ft. of floor area. Equipment, besides standard classroom items, should include a planning center, additional bookcases, and filing cabinets. Pupil stations may be two or four pupil tables, or some flexible combination of pupil tables.

80.42 Office. The teacher-coordinator's office should adjoin and open into the classroom. It may be small, 90 to 100 square feet, and should provide supervision of the classroom by means of a vision panel. It should have space for a desk, file, book shelving, and a conference area.

If the D. O. classroom is used as a related classroom for shop classes or for other subjects, a separate door to the office should be provided.

SECTION 81.0 VOCATIONAL AGRICULTURE

Section

81.1 Purpose. Vocational Education in Agriculture is designed to meet the needs of persons who have entered upon or are preparing to enter the work of the farm or any occupation involving knowledge and skills of agriculture subjects

Programs of instruction may be offered to secondary and post secondary students, beginning or adult farmers, and for employees, supervisors or managers who are engaged in or preparing to enter occupations which perform one or more of the agricultural functions of servicing farmers, or the processing or distribution of farm products.

Vocational agriculture in the school involves the broad areas of agricultural science and mechanized agriculture.

81.11 Instructional Activities. These include:

(1) Group instruction and planning; informational reading; leadership training.

(2) Learning approved methods of production and marketing; judging of grains, livestock, fruits, and vegetables.

(3) Preparation of livestock, poultry, and dairy products for the market or storage.

(4) Farm management and conservation.

(5) Farm carpentry; servicing and reconditioning farm tools, machinery, and equipment.

(6) Participation in state and national organizations such as the Future Farmers of America and adult farmer groups.

81.2 Teaching Stations. Local needs of both in-school and out-of-school youth and adults will determine the extent of facilities. In planning facilities for the in-school enrollment, one of the programs recommended by the state vocational agriculture unit should be adopted and the number of needed teacher stations determined. Class size should be 15–18 pupils.

$$\text{Teaching stations*} = \frac{\text{In-school enrollment in agriculture}}{\text{Class size x number of periods available}}$$

---

*Only the shop should be considered a teaching station in estimates. There may be one or more related classrooms, depending on the number of teachers and program.

81.3 Facilities

81.31 General

a. Arrangement and Location. The classroom, laboratory, office-conference room, and mechanized agriculture instruction area should be arranged as an integral unit to provide for instruction and supervision of pupils in more than one area at a time. The unit should be located on the ground floor with entrances, including the large overhead door, located for easy accessibility and freedom from traffic hazards, sharp turns, steep grades, and poorly drained areas

b. Space for agriculture should provide for: (1) office-conference area, (2) classroom, (3) laboratory, (4) mechanized agriculture shop facility, and (5) necessary storage. An adjacent fenced-in machine court with some covered work-storage area is desirable.

Section

81.32 Office-Conference Room. Provide:

(1) About 200 sq. ft. of floor space per teacher: space for desk(s), conference table and chairs, filing cabinet, adding machine, typing table, wardrobe and storage.

(2) Entrance easily accessible from outside, from the classroom, and from the shop.

(3) Observation windows in partition so that the classroom and shop are at least partially visible from the office.

(4) Arrangement so that office can be used as a conference or committee room.

81.33 Classroom. Include:

(1) Areas for recitation, discussion, pupil work activities, teacher demonstration, storage.

(2) About 840 sq. ft. of floor space (minimum 720 sq. ft.).

(3) Sufficient 2-pupil tables and chairs for the largest class. See Department of Education "Suggested Layouts" for arrangement.

(4) Drawer or partitioned shelf for each pupil to use in storing notebooks, record books and laboratory equipment.

(5) Twelve linear feet of chalkboard at the front of the classroom.

(6) Thirty sq. ft. of bulletin board space of material that will accommodate thumbtacks.

(7) Shelf space for magazines and bulletins.

(8) Provision for use of audio-visual aids: A-V screen, duplex electrical outlets at 10′ to 15′ intervals; darkening shades.

(9) Lighting, sound treatment, ventilation, floor covering, color harmony: same standards as for classroom.

(10) Classroom storage: adjacent to the classroom and office (may be a part of the office or laboratory) that will provide for:

   (a) Rodent-proof storage for feeds and seeds.

   (b) Charts, filmstrips, slides, tapes.

   (c) Seed and soil testing equipment.

   (d) Clippers, wool card, hog markers and other livestock equipment.

   (e) Veterinary supplies and insecticides.

   (f) FFA supplies and equipment.

81.34 Laboratory. Will require from 180 to 220 square feet of floor space for laboratory activities such as soil testing, seed germination, grain grading, and milk testing. Equip with acid resistant work counter and sink, storage cabinets; electrical outlets for electrical equipment.

81.35 Mechanized Agriculture Shop

a. Space. Provide a minimum of 2400 sq. ft. of floor space, with 150 sq. ft. of floor space per pupil in the largest class.

b. Work Areas. Such shops usually include work areas for farm carpentry, hot and cold metal, electrical work, tool maintenance and repair, farm plumbing, painting, concrete

Section

work, maintenance of farm power units, care and repair of farm machinery, and power transmission.

NOTE: See Section 134, Fire Marshal's regulations: "Hazardous Areas."

c. EQUIPMENT. Should include: wall type work benches (woodworking, electrical, mechanics, paint, metal working) with appropriate tool cabinets for each; overhead hoist, forge, anvil, gas and electric welding booths, pipe work table and tools, drills, grinders, radial arm saw, parts washer, steam cleaner, air compressor and assorted small working tools.

d. ARRANGEMENT. The equipment should be arranged so that large open floor areas will be provided for work on farm machinery and construction of large projects. Other work areas should be on or adjacent to perimeter walls.

e. SHOP SUPPLY STORAGE. Provide at least 160 sq. ft. of floor space for supply storage; in a lockable room at least 16′ long; door or entrance near the end so that long lengths of lumber and bars of steel can be taken in and out easily from suitable racks; separate racks for storing sheet metal and plywood (overhead).

f. OVERHEAD DOOR. Entrance near machinery court; at least 12′ to 14′ wide and small access door provided near overhead door.

g. WINDOWS. Bottoms at least 60″ from the floor to permit work benches to be built under them; located so that there is sufficient wall space for at least six tool cabinets (5′ of wall space per cabinet); sills sloped 30° to prevent them from being used as storage space.

h. FLOOR. Minimum of 5″ reinforced concrete; smooth troweled and level except in drainage area, sealed to prevent absorption of grease and oil; industrial type floor drain, with removable sediment bucket, near the door; a 2″ pipe embedded in the concrete floor under the large machinery door to serve as a threshhold.

i. HEATING. Heating system of a quick recovery type, adequate to keep the shop at 60° to 65° F. when classroom is 72° F: zoned for heating independent of other school facilities for evening classes for adults.

j. VENTILATION. See the following sections under Heating and Ventilation:

Sec. 252.1 Exhaust Systems
252.2 Local Mechanical Exhausts
252.4 Paint Spray Booths
252.6 Garages
252.7 Hoods, Shop: Forge, Welding, Soldering.

k. ELECTRICAL. Power requirements will be determined by machines used. Provide:

(1) A service entrance wiring plan to allow for a liberal and long-term expansion of facilities.

(2) A master circuit breaker switch panel which controls power equipment conveniently located and provided with a lock.

(3) Overhead electric service: 120/208 volt 4 wire providing single phase or three phase current for machines requiring electric power. Floor electric service is not recommended.

(4) A sixty ampere circuit of single-phase 230 volt current for each two alternating current 180 ampere farm type welders.

Section

(5) Sufficient 230 volt outlets provided so that at least four arc welders can be operated in the arc welding area. Additional 230 volt outlets arranged around the walls of the shop so that welding can be done at several places in the shop (primary and secondary cables on arc welding machines are about 25′ long).

(6) One 230 volt welding outlet adjacent to the overhead machinery door or in a weatherproof box on the outside of the building.

(7) 115 volt plug receptacles located at 10′ to 15′ intervals along each wall of the shop; 115 volt plug receptacles located above the height of the work bench or flush with the front of benches.

(8) One or more 115 volt weather-proof plug receptacles on the outside of the building.

(9) One or more floodlights available to illuminate the machinery area and entrances for night use.

(10) All stationary electrical machines properly grounded; all portable electric tools provided with ground wires and with suitable plugs to connect these ground wires.

l. LOCKER AND SANITARY FACILITIES

(1) A metal locker for each pupil to store shop work clothes, located conveniently near the hand washing area; the lockers on a raised concrete ledge (4″ to 6″).

(2) A wash basin near the clothes locker area, (round or half round) at which half the members of the class can wash at one time.

(3) Toilet facilities in or adjacent to the agriculture department.

81.36 Machinery Court (Optional). General Features:

(1) Storage space outside the shop, partially protected from the weather, that can be used for storing machinery in the process of repair.

(2) The machine storage area screened from public view by fences, walls, or hedges.

(3) The storage area large enough to hold 6 to 10 machines or vehicles; the area paved or hard-surfaced; accessible by a large gate.

(4) An outside wash rack for washing equipment with provision for drainage; a metal storage rack for storing pipe and steel stock; a bin for storage of scrap steel to be sold as junk.

(5) An outdoor loading ramp near the machinery court to facilitate the loading and unloading of farm equipment.

81.4 SUGGESTED LAYOUTS. The School Plant Planning Section of the Department of Education, in cooperation with the state agriculture education unit and agriculture education commission of the Minnesota School Facilities Council, has developed Suggested Layouts for One, Two and Three Teacher Agriculture Education Departments. Suggested Total Area for each type of department is stated below:

One Teacher Department	3825 sq. ft.
Two Teacher Department	4340 sq. ft.
Three Teacher Department	5040 sq. ft.

These suggested layouts can be obtained upon request from the School Plant Planning Section, Department of Education, 400 Centennial Building, St. Paul 1.

SECTION 82. BUSINESS EDUCATION

Section

82.1 Program. Business Education in Minnesota secondary schools provides courses about business and courses for business. Courses about business contribute to both job preparation and general education. Courses for business are of a vocational nature and are intended primarily for pupils preparing for business occupations. These latter courses are specifically concerned with the development of skills needed in office occupations.

82.11 Curriculum. In addition to courses offered to adults in evening programs, the secondary business education curriculum may include:

#Basic Business
#Business Law
Business Machines
#Business Organization and Management (S)
#Bookkeeping
Office Procedures
#Consumer Education (S)
#Economic Education (S)
Electronic and Data Processing
Office Cooperative Training Program
*Personal Typewriting (S)
Record Keeping
Stenographic Office Procedures
Shorthand I and II
#Speedwriting or Notehand or other abbreviated systems (S)
Typewriting

NOTE: Unmarked courses are vocational courses. Semester courses are indicated by (S).

#These courses are offered both for job preparation and as general education electives.

*General education elective, solely for personal use.

82.2 Teaching Stations

82.21 Enrollment. The local school authorities should determine the program to be offered and the anticipated enrollment in each subject, and from these figures calculate the needed facilities.

82.22 Sections and Facilities. The following formula may be used to determine the number of sections for each subject:

$$\text{Number of Sections} = \frac{\text{Enrollment in Subject}}{\text{Desirable (or maximum) Class Size*}}$$

---

*State Board Regulations: Typing—maximum 40 pupils
Office Practice—maximum 20 pupils

Section

After the number of class sections is calculated, the number and type of rooms and facilities can be determined.

82.3 Types of Rooms and Size

82.31 Size. The SIZE of each room is determined by the type of facility, number of pupil stations, kind of furniture, equipment, and class activities within.

82.32 Types of Rooms. The number of rooms to be provided will affect the selection of room types. Rooms that may be considered follow. Approximate space requirements are given.

Facility		Approximate Sq. Ft.
Multi-Use 1-Teacher Business Department		1200
3-Room Suite (2 to 3-Teacher Department)		3000
Typing	1000	
Office Procedures and Business Machines	1000	
Bookkeeping and General Business	1000	
Typing Classroom and Laboratory (May be used for shorthand and transcription as well)		1600
Bookkeeping and General Business		1000
Advanced Shorthand-Typing		1000
Office Procedures and Business Machines		1200
Data Processing Classroom Laboratory		1600

NOTE: Layouts for the above rooms may be obtained from the School Plant Planning Section or Business Education Unit, State Department of Education, Centennial Office Building, St. Paul.

OFFICE AND WORK CENTER. Large schools may wish to provide a Departmental Office and Work Center. The following example gives a basis for planning:

	Sq. Ft.
Departmental office area (5 teachers at 50 sq. ft.)	250
Individual pupil study-work space (12 at 25 sq. ft.)	300
Reference Center (Teacher and pupil)	250
Central storage	200
Vocational Coordinator's Office	200
TOTAL	1200

EXAMPLES OF SELECTION OF ROOMS: (Secondary School Building)

School A (Large Metropolitan)

(1500–2000 pupils)
2—Typing classroom labs
1—Advanced shorthand-typing
1—Office procedures and business machines
1—Bookkeeping and general business
1—Department office and work center
1—Data processing classroom laboratory (Optional)

School B (Medium Size)

(600–1200 pupils)
3-room suite:
Typing
Office practice and business machines
Bookkeeping and general business

OR

2-room suite:
Multi-use classroom
Bookkeeping and general business

School C (Small)

(300–600 pupils)
Multi-use classroom laboratory (1-teacher)

OR

2-room suite as indicated in School B, using Bookkeeping room for some general classes

NOTE: Actual room selection will be based on the specific local programs and enrollment.

82.33 Typewriting Room. Each typewriting station should have an adjustable desk at least 18" x 36" and a posture chair. Typewriting desks are best arranged in pairs. (Maximum number of stations: 40)

Space is needed for a teacher demonstration stand in front of the classroom, teacher's desk, file cases, book shelving, movable table, and teacher's wardrobe and storage.

A room measuring approximately 30' x 36' will adequately house 36–40 pupil stations. Consideration should be given to a small student practice and work room about 30' x 9', with access from the classroom and corridor, equipped with a number of typing desks for practice, counter with sink and cabinet storage beneath. Observation windows in the partition between the classroom and workroom will permit the teacher to supervise both rooms. If a workroom is not provided, provide counter and sink in classroom.

Since most if not all typewriters will be electric, provide electric floor ducts.

82.34 Shorthand-Typewriting Room. Where enrollment in beginning and advanced shorthand justifies a separate room, the shorthand-typewriting room should be considered.

Provide typewriting stations similar to those in the typewriting room, or L shaped desks (18" x 48") and chairs, teacher's desk, file cases, demonstration stand, teacher's wardrobe and storage, counter with sink and adequate storage below; electric floor ducts for electric typewriters.

For 30 pupils, a room measuring approximately 29' x 35' (about 1000 sq. ft.) will be adequate; for 25 pupils a room 29' x 30' or about 900 sq. ft.

82.35 Bookkeeping and General Business. Potential uses are for classes in bookkeeping, basic business, economics, business organization and management, business law, or other academic courses related to business.

Provide: desks with at least 700 sq. in. of work area, student chairs, teacher's desk and chair, file cases, movable table, low book-shelving, counter with sink and storage (shallow drawers) below, teacher's wardrobe and storage.

A room measuring about 29' x 35' or about 1000 sq. ft. will adequately provide for 30 pupils.

82.36 Office Procedures and Business Machines Laboratory. Should be conducive to teach clerical and stenographic procedures, business machines, transcription, filing, advanced typewriting and other advanced job preparatory concepts or courses.

In the LABORATORY-CLASSROOM area, pupil stations consist of two-level "L" desks and secretarial chairs which may be grouped in cluster of 4 desks, adapted to a rotation system of assigning varied tasks and duties to designated centers. The laboratory-classroom area provides along one wall a counter with sink, and shelving and drawers beneath. Additional furniture includes an instructor's desk, files, demonstration stand, a secretarial desk, movable tables and book shelving.

Two auxiliary rooms adjoin the main laboratory area, a TRANSCRIPTION room and an OFFICE-CONFERENCE room,

separated from the laboratory area by a partition with observation windows. The transcription room contains four or five pupil stations ("L" desks and swivel chairs); the office-conference room: wardrobe and storage, desk, files and chairs.

Furniture (Minimum)

20—"L" type student desks
20—secretarial chairs
1—demonstration stand
2—movable tables (30x72)
3—two drawer files
1—bookcase or unit of shelving

Equipment (Minimum)

10 to 20 manual typewriters
5—electric typewriters
2—adding machines, 10 key electric
2—adding machines, full key electric
2—calculators, electric print
2—calculators, electric rotary
1—duplicating machine, mimeograph, stenoscope and styli
1—duplicating machine, spirit, stenoscope and styli
1—transcribing machine
1—towel dispenser for sink

Additional DESIRABLE equipment includes dictating machine, key punch machine, collator, tape recorder, phonograph, and overhead projector and screen.

Suggested floor areas for unit adequate for 20 pupil stations:

Laboratory classroom	about 900 sq. ft.
Transcription room	about 150 sq. ft.
Office-conference room	about 150 sq. ft.*

82.37 Multi-use Laboratory. The multi-use laboratory may be used for a variety of purposes. The small school may use it to teach typewriting, shorthand, transcription, office procedures, bookkeeping and others. In schools that have large enrollments the multi-use laboratory may be used for Shorthand II or transcription. The room is primarily designed for a ONE ROOM DEPARTMENT and should have an auxiliary room for practice, work, and conference, separated from the classroom area by a partition with observation windows.

Pupil stations in the main area consist of "L" type student desks with secretarial chairs; additional furniture: teacher's desk, files, demonstration stand, and low shelving. In the adjoining auxiliary room, there are typing desks for practice; counter with sink, drawers and shelving beneath; table; teacher's wardrobe and storage.

The use of the multi-use laboratory will indicate the essential furniture and equipment. As a minimum, the following should be included:

---

*Some schools may prefer to use this space for a work room containing counter, sink, storage cabinets, duplicating machines. This would remove the duplicating center from the laboratory-classroom. Teacher's wardrobe and storage. conference area would then be located in the laboratory-classroom.

Section

Furniture

- 20 to 25 "L" type student desks
- 20 to 25 secretarial chairs
- 1—demonstration stand
- 1—utility table
- 3—two drawer files
- 1—teacher's desk and chair

Equipment

- 20 to 25 manual typewriters
- 1—for each 10 pupils enrolled in office procedures class:
  - electric typewriter
  - adding machine, ten key electric
  - adding machine, full key electric
  - calculator, electric printing
  - calculator, electric rotary
  - duplicating machine, mimeograph
  - duplicating machine, spirit
  - stenoscope and styli for each duplicating machine
  - transcribing machines
- bookcase or shelving
- towel dispenser for sink

SUGGESTED FLOOR AREA for multi-use laboratory:

Main classroom area	about 900 sq. ft.
Auxiliary practice-work area	about 300 sq. ft.

82.38 Data Processing Classroom Laboratory. The electric data processing program and facility should offer the flexibility needed to:

(1) Provide exploratory experiences to secondary school pupils which may lead to training for occupations in the field;

(2) Train post graduates for entry employment in occupations in the field of less than degree status.

FACILITY SIZE AND EQUIPMENT. The type of training program decided on will give direction to the class size, facility size, and equipment. Generally, class size for training for occupations should not be less than 15 or more than 20. The following training areas and approximate size are suggested:

Classroom with Office-Conference Room	700 sq. ft.
Unit Record Laboratory	500 sq. ft.
Computor Laboratory	400 sq. ft.
Classroom-Laboratory Unit (about)	1600 sq. ft.

For suggested equipment, see Department of Education "Suggested" Layout."

Section

School officials planning to install a Data Processing Laboratory, either in a new or existing building, should confer, early in the planning, with the School Building Planning Section and the Office Procedures Unit, Vocational Education Section in order to keep pace with new developments in this fast expanding field.

82.4 OTHER DETAIL. Provide:

82.41 Tackboard. Not less than 20 lineal feet, 42" high in each room.

82.42 Display Rail. At top of chalkboard and tackboard in all rooms.

82.43 Teacher's Wardrobe and Storage. In each general classroom area or in office and conference area when this auxiliary room provided.

82.44 Chalkboard. About 20–24 lineal feet.

82.45 Shelving or Bookcase. About 12–16 lineal feet of adjustable shelving, either open shelving or bookcase with glazed doors, in classroom areas.

82.46 Work Counter and Sink

	Counter*		
Facility	**Lin. Ft.**	**Height**	**Sink**
a. Typewriting Room	16′#	36″	yes
b. Shorthand-Typewriting	20′	36″	yes
c. Bookkeeping—General Business	12′#	29″	no
d. Office Procedures—Business Machines	30′–32′#	29″	yes
e. Multi-use Laboratory	12′	32″	yes
f. Data Processing Laboratory	(Consult state specialists)		

---

*Suggested lineal feet. Consult "Suggested Layouts" for cabinet detail below counters.

#Provide: knee space(s).

82.47 Electrical Outlets. Provide:

a. An outlet at the front and rear of each room for audio-visual aids.

b. One outlet over each work counter as far away from sink as reasonably possible.

c. Outlets as needed or plug-in strips on walls or over counters for business machines.

d. Under floor ducts (about three) with outlets as needed for electric typewriters or business machines.

SECTION 83.0. DISTRIBUTIVE EDUCATION

Section

83.1 **Program.** Distributive Education is a program of vocational instruction in the marketing, selling and distribution of goods and services. The secondary school program is designed to serve young people who are interested in sales and merchandising jobs, or careers found in such distributive industries as retailing, wholesaling, manufacturing, storing, financing and services.

The distributive education program usually consists of a two-year sequence: Merchandising and Sales I, a pre-employment course, and an advanced course for seniors, Merchandising and Sales II.

The classroom instruction in distributive education necessitates adequate laboratory facilities and equipment. If the distributive education program involves a cooperative program (part-time employment), a coordinator's office should be provided. The office offers the needed privacy to confer with students on job progress and personal problems related to their job as well as to maintain communications with employers and other prospective business firms.

83.2 **Location.** The distributive education room should be located near the business education unit and a public area with an outside entrance, so it may be used for adult evening classes. It should also be near the center of student traffic, to make effective use of the display window.

83.3 **Number of Facilities.** The number of rooms provided for distributive education will vary with the size of the school and the types of distributive occupations included in the training program. A desirable number of pupil stations per class section is about 25.

83.4 **Type of Facilities.** The distributive education unit is made up of:

a. **General classroom area:** Equipped the same as a general classroom in respect to chalkboard, tackboard, chart rail, shelving or bookcases; with locked storage for equipment and supplies since the room may be used for other secondary classes and adult classes after school and evening.

b. **Auxiliary Areas**

(1) **Merchandising and display area:** which may be separated from the classroom by accordion folding doors.

(2) **Work-storage area:** separated from the merchandising and display area by a partition with sliding door.

(3) **Office conference room:** with access from the classroom, corridor, and work-storage areas; observation window to classroom and glass in door to storage room.

Section

83.5 **Floor Space.** The floor space should be sufficient to accommodate up to 25 pupils as well as an office and a merchandising laboratory. The space should be large enough so that the room may be used for other non-distributive education classes which usually run larger than 25 pupils. The following space is recommended:

General classroom	840–900 sq. ft.
Merchandising, display and work storage areas	290–300 sq. ft.
Office and conference room	90–100 sq. ft.

83.6 **Equipment**

a. **General Classroom.** Pupil stations in the general classroom consist of movable single or two-pupil tables and chairs; tables may be trapezoidal or rectangular, permitting flexible arrangement.

b. **Merchandising Display Area.** Special Equipment:

Wall display case
  glass front, adjustable shelves.
Portable display counter
  glass front, sides and top.
Wall display case
  glass front, pegboard backing, adjustable shelves, and a bottom drawer.
Storage cabinet
  lockable doors, adjustable shelves.
Wall display case
  garment hanger, adjustable shelves.

c. **Work-Storage Area.** Provide work counter, sink, storage cabinets with lockable doors and adjustable shelves.

d. **Office-Conference Area.** Provide desk, chairs, file cabinet, wardrobe.

83.6 **Other Detail**

a. **General.** Provide heating, ventilation, lighting, acoustical treatment the same as for a general classroom; light control device for audio-visual aids.

b. **Electrical.** Provide electric outlets for: audio-visual aids; cash register or any other business machines that may be used; for lighting display case and spotlighting of display area. Provide outlet above work counter in work-storage area; telephone jack in office-conference room.

c. **Layout.** A suggested "layout" for a Distributive Education Unit is available upon request from the School Building Planning Section or from the state supervisor of Distributive Education, State Department of Education. For further information as to instructional equipment and supplies, consult the state supervisor of Distributive Education.

SECTION 84.0 HOME ECONOMICS EDUCATION

84.1 Scope. The purpose of home economics education is to provide for both youth and adults, opportunities and experiences which assist them in becoming more effective members of family groups. It also provides related occupational information and some specific preparation for employment in occupations using homemaking knowledge and skills. The study of home economics encompasses work in all aspects of home living and the related service areas and will require facilities in both the junior secondary and senior secondary periods for courses in these areas. Instructional units or courses for which space, furniture, equipment, and storage must be provided include the following:

(1) Observation, care and guidance of children.
(2) Consumption and other economic aspects of personal and family living.
(3) Development of creative, social, managerial and manipulative skills.
(4) Development of a satisfactory and pleasant relationship with family and friends.
(5) Self expression in selection and care of the house and its furnishings.
(6) Selection, use, and the care of home equipment.
(7) Development and maintenance of health and home safety.
(8) Selection, preparation, serving, and conservation of food.
(9) Selection, renovation, and construction of clothing

84.11 Minimum Program. At least two full years of home economics instruction must be maintained in a department in a junior secondary school, at least one full school year in a department in a senior secondary school and at least three full school years in a home economics department in any other type of secondary school.

In the junior secondary period, home economics is a constant subject (one semester) in the 7th and 8th year, or it may be taught for one full school year in either the 7th or 8th year. It is an elective in the 9th year. In the senior secondary period it is an elective subject, grades 10–12. It is scheduled five periods per week throughout the school year.

84.2 Planning for Flexibility. Provide:

a. Settings for servicing large groups and small groups through:
   presentations and demonstrations
   discussions
   observations and experiences
   individual study
   experimentation

b. Adaptable facilities for essential laboratory work:
   large free areas
   movable equipment and storage cabinets
   adequate storage
   many well-located electrical outlets; spare or extra water service.

84.3 Trend in Curriculum Organization. The pattern of organization of the home economics curriculum may vary from the traditional separation into different class groups, such as foods, clothing, family living, etc., to the INTEGRATION of these areas of the curriculum so that one teacher deals with all of them in one ALL-PURPOSE room.

In small secondary schools, where one-teacher departments are common, the all-purpose home economics unit is an economical and effective way to provide the needed facilities. In junior secondary schools and even in large senior secondary schools, there is a definite trend toward providing flexible all-purpose units to meet enrollment and program needs.

84.4 Some Types of Home Economics Facilities and Suggested Floor Space.# Depending upon the size of the school and upon basic decisions of curriculum organizational patterns, the following space divisions may be considered:

84.41 One Teacher Department	**Approximate Area**
a. One ALL-PURPOSE AREA, containing centers for basic courses and auxiliary spaces	2000 sq. ft.
(1) AUXILIARY SPACES: laundry and storage areas separated from main room by folding partition; one-half bath for child care is optional.	

84.42 Two-Teacher Department*	
a. Combination FOODS AND CLOTHING AREA	1300 sq. ft.
b. Combination FLEXIBLE MULTIPLE-PURPOSE AREAS, containing centers for selected courses or units	1400 sq. ft.
	2700 sq. ft.
(1) AUXILIARY SPACES: centrally located between the two main areas and for the use of both teachers. Include: (a) work storage and laundry areas with access from both main areas and in full view of pupils in multiple-purpose area when folding partition is open; (b) one-half bath.	

84.43 Three Teacher Department*	
a. Foods Area	1260 sq. ft.
b. Flexible Multi-Purpose Area, containing centers for selected courses (Area A)	1050 sq. ft.
c. Flexible Multiple-Purpose Area, containing centers for selected courses (Area B)	1050 sq. ft.
d. Auxiliary Space between Area A and Area B	420 sq. ft.
	3780 sq. ft.

#Layouts for these types of facilities may be obtained upon request from the Home Economics Unit, or School Plant Planning Section, State Department of Education.

*Other satisfactory combinations may be designed for schools requiring more than a single all-purpose room.

Section

(1) AUXILIARY SPACE provides for:

- (a) Home furnishings and home kitchen centers, separated from Areas A and B by folding partition.
- (b) Home laundry center and child care center (with ½ bath), and with access from Areas A and B.
- (c) Storage space for Areas A and B, including portable sewing machine storage, with access from Areas A and B.

84.5 SUGGESTED EQUIPMENT FOR PRINCIPAL WORK CENTERS

84.51 Unit Kitchens—L or U shaped, each to accommodate 4 pupils. Each unit kitchen to provide:

(1) Ranges—divided range, or electrical appliances; gas or electric.

(2) Sinks—double and/or single basin; porcelain and/or stainless steel, near center of unit.

(3) Tables 27″ to 29″ high, no apron, some trapezoidal, some half-round, some rectangular (42″ x 60″ except for food service 42″ x 36″).

(4) Chairs—non-folding.

(5) Wall Cabinets—at least 2, each approximately 30″–36″ wide; at least 1 foot from corners of unit kitchens.

(6) Base cabinets—at least 12–15 lineal feet of counter space with cutting and pastry boards, adjustable shelves and drawers; adjustable dividers and rotary corner shelves desirable; make some of the arms which extent out into the room movable.

(7) Cooking utensils—family size; garbage container; serving dishes; glassware; flatware; linens; staple food containers.

GENERAL USE

(1) Refrigerator-freezer combination—one or two near entrance and unit kitchens.

(2) Fire extinguisher and blanket—near unit kitchen.

(3) First Aid Kit—accessible to unit kitchens.

(4) Storage cabinets—along or near wall, for:
- (a) Food staples—near refrigerator. Both wall and base cabinet desirable.
- (b) General storage.
- (c) Cleaning supplies.

(5) Garbage disposal.

(6) Dishwasher—may be portable.

(7) Demonstration mirror—portable.

(8) Pegboard—portable, on standard.

(9) Service cart.

Section

84.52 Clothing Work Center. Provide:

- a. Tables—27″–29″ high, no apron, glides on underside for tote trays; may be rectangular (42″ x 60″) or some may be trapezoidal.
- b. Chairs—non-folding.
- c. Sewing machines—at least one for each group of 3 pupils; 1 automatic machine desirable.
- d. Mirror—full length, double or triple, with some means of providing privacy.
- e. Lavatory—unless all purpose department.
- f. Ironing board—full size and table model; 1 for each group of 8 pupils.
- g. Iron—steam; 1 for each group of 8 pupils.
- h. General use:
  - (1) Storage cabinets—along or near wall:
    - (a) Wardrobe—for unfinished garments, one or two adjustable rods.
    - (b) Tote tray—for pupils' sewing supplies, each tray about 12″ x 18″ x 4½″.
    - (c) Pressing equipment.
    - (d) Cleaning supplies.

84.53 Family Living Center

- a. Furnishings:
  - (1) Sofa—may be bed type, some exposed wood.
  - (2) Occasional chairs—one or more, some exposed wood.
  - (3) Chest of drawers or desk.
  - (4) Table—dropleaf and expandable.
  - (5) Open shelves—in sections and movable.
  - (6) Decorative accessories.
  - (7) Draperies or glass curtains.

84.54 Laundry Center

- a. Washer.
- b. Dryer.
- c. Ironing board and iron.
- d. Base and/or wall cabinets for supplies and linens.

84.55 Child Care Center—may be combined with family living or clothing center.

- a. Tables and chairs—low, may be borrowed.
- b. Steps—for lavatory, toilet, and drinking fountain.
- c. Games; play materials; toys.
- d. Books
- e. Hooks or racks for wraps—low.
- f. Storage cabinets for equipment and supplies.

84.56 Discussion and Planning Center

- a. Two-pupil tables; trapezoidal, half-round, or rectangular to accommodate enrollment.
- b. Chalk board—8–12 lineal feet; portable board may be necessary.

Section

c. Tack board—8-12 lineal feet.

d. Peg board desirable.

e. Screen and overhead projector.

f. Darkening shades or draperies.

84.57 Teacher's Work Center in each room.

a. Desk.

b. Filing cabinet.

c. Wardrobe with lock.

d. Cabinet (minimum 8')—for teaching materials; some adjustable shelves and shallow drawers or sliding trays.

e. Shelves—open and movable; for pupils' belongings from other classes and for books and magazines.

84.58 **Display case** is desirable; interior lighting; tackboard at ceiling as well as sides and back.

84.6 OTHER DETAIL

84.61 **Equipment.** Locate large fixed equipment and storage cabinets along or near the walls so that the center of room is left free for flexible arrangements of movable equipment. Overall wall cabinet height should not exceed 6'-9".

84.62 **Screens.** All openable windows in areas containing food preparation or service centers must be screened.

84.63 **Walls.** Should be painted or finished with materials which are attractive and can be easily cleaned; ceramic tile wainscot desirable in child care and bathroom areas.

84.64 **Floors.** Provide suitable materials and finish which are attractive and easy to keep clean; grease proof floor in foods area; ceramic tile in child care and bathroom areas.

74.7 SERVICES

84.71 **Heating.** A separate heating zone is desirable, especially when used after school hours by adults.

84.72 **Ventilation.** See Table 241.1. See Sections 252.2 and 252.4 Kitchen Exhaust Systems; 252.41 Kitchen Hoods.

84.73 **Plumbing.** Provide adequate and properly located plumbing connections for the necessary equipment in each teaching center. There must be a continuous supply of hot water. This may require a separate hot water heater. A water softener for laundry and dishwashing is desirable.

Disposal. Provide at least one garbage disposal unit for each food room.

Section

Gas. When more than two gas outlets, master control valve is a requirement. See Section 132.2. Provide gas as well as electric service in laundry area.

84.74 **Electric Service System.** Circuits must provide a capacity ample for sewing machines, electric ranges, washer, dryer, ironer, refrigerator, freezer, numerous small appliances, and for adequate levels of artificial, low-brightness lighting. Provide appropriate electrical circuits for domestic type electric ranges, washers, dryers, and water heaters.

CONTROL PANEL. A separate control panel for the homemaking area is desirable, making it possible to cut the current to all outlets and equipment except circuits for the refrigerator and freezer.

OUTLETS. Provide ample switches and outlets on each wall in each laboratory room. Special floor outlets should be staggered in the room for flexible arrangements of tables and machines used in clothing construction. These outlets should be flush with the floor in boxes with slanted outlets.

TELEPHONE JACK. Provide telephone jack in department.

84.75 **Visual Comfort.** Provide artificial light sufficient to furnish 50-70 foot candles in classroom areas and 150 foot candles in clothing area; control of natural light by venetian blinds or separate shades for upper and lower sash. See Section 193.3.

84.76 **Audio-visual.** Install light control devices on all windows for audio-visual work. See Section 196.2.

84.77 **Sound Control.** Efficient acoustical controls are necessary in the laboratory spaces, especially where movable or folding partitions are used between areas. See Table, Section 177.1.

84.78 **Fire Safety.** For "fire blanket" requirement, see Section 131.16; for "fire extinguisher" requirement, Section 131.13.

84.8 LOCATION. Preferred location is on the ground or first floor for convenience of delivery, removal of wastes, easy access to child care center and use of the whole department by adults after regular school hours. Locate with respect to affinity of home economics facilities to other areas of the curriculum; for example, industrial arts, arts and crafts. Consider the future need for expansion, with attention to layout of plumbing and other service facilities to foster such expansion.

SECTION 85.0. AREA VOCATIONAL-TECHNICAL SCHOOL FACILITIES

Section

85.1 SCOPE. Area Vocational-Technical Schools are designed and receive financial assistance on the basis of serving an area considerably larger than the local school district. It is the purpose of the area vocational-technical school to more nearly equalize the educational opportunities in certain phases of vocational education to youth and adults of the state who can profitably pursue training for a specific occupation. Secondary and post secondary school students may attend with the latter the most often predominant.

85.2 PROGRAM. Programs of area schools are not restricted to the occupational needs of the local district. The area school offers day-trade and day-technical preparatory courses and meets the agriculture, business, distributive and home making needs of the area. Graduates of area vocational-technical schools are placed in occupations in all parts of the state.

85.3 FACILITIES. Facilities and equipment, space and auxiliary areas must be based on experience and standards recommended by representatives from the occupations for which the training is to be given. The following tabulation may be used as a PRELIMINARY GUIDE for planning area vocational-technical program spaces for some typical programs:

Type of Program	Minimum Areas Needed Square Feet
Air Frame and Power Plant Mechanics	7200
Appliance Repair	3000
Auto Body Repair	6000
Auto Mechanics	6500
Business and Office Education	
Clerical	2000
Electronic Data Processing	2400
Junior Accounting	1200
Stenographic and Secretarial	1200
Unit Records	1500
Carpentry	4000*
Chef and Cooks Training	1500
Classrooms—Related Subjects	800–900
Commercial Art	2000
Cosmetology	2400
Dental Assistant	2000
Distributive Education	1800
Drafting	
Architectual	1400
Construction	1600
Highway	1400
Machine	1400
Diesel Mechanic	5000
Electrician	
Construction	2400
Lineman	2400
Maintenance	2800
Electronics	
Industrial	2400
Television and Radio	2000
Communications	2000
Farm Machinery Repair	6000
General Mechanics: Appliance, Heating and Air Conditioning	3200–3600
Highway Technician	1500
Machine Trades	
Machinist	3000
Tool and Die Maker	2400
Tool Design Technician	1400
Practical Nursing	1500
Printing (Graphic Arts)	2400
Welding	1800–2400
Library	900–1800**
Student Lounge and Luncheonette	1800#
Administrative and Counseling	1200–2000

---

*For inside work. If considerable work done outside, may be reduced by one-half.

**Includes student study area.

#For about 250 students.

NOTE: The actual areas needed for instructional spaces will depend on the number of instructor stations needed and the maximum class size.

85.4 FINANCIAL ASSISTANCE FOR CONSTRUCTION AND REMODELING

Subject to amendment, the following procedures are to be followed by school districts making application for area vocational-technical school designation and facilities—new buildings, new additions, or substantial remodeling of existing buildings.

Procedures:

(1) The local vocational director, superintendent, and school board, in coordination and conference with the state director of vocational education and vocational staff, will determine the program and courses to be offered in the local facility.

(2) The program, constituting the shop, laboratory, and classrooms, courses will be formally approved by the state director of vocational education.

(3) This approval will include recommended space sizes for classrooms, shops, laboratories, office, library, conference, and storage facilities.

(4) A duplicate copy of the approved program and space recommendations will be sent to the state director, school plant planning section. Any subsequent changes will be transmitted in a like manner.

Section

(5) The planning of the area vocational-technical school facilities will involve the state director of school plant planning working jointly with the local vocational director, the superintendent of schools, the school board, the staff of the vocational section, and the architect, both as to preliminary plans and final working drawings.

(6) Final approval of working drawings will be made by the state director of school plant planning after consultation with the state director of vocational education or staff members designated by him.

Section

(7) Any unilateral deviations from these plans during construction which adversely affect the vocational program may result in withholding federal funds or aids allotted to the project.

NOTE: The granting of federal funds or federal and state aids to a school district for construction of vocational school or conduct of vocational programs is based upon an agreement between the local board of education and the state board of vocational education (State Board of Education).

Application forms for financial assistance for construction or remodeling, after prior notice that such funds are available, may be obtained from the State Department of Education, Vocational Education Section.

SECTION 86.0. VOCATIONAL COOPERATIVE TRAINING PROGRAMS

86.1 General. A Vocational Cooperative Training program is an instructional procedure in which students in one or more types of vocational education programs enter part-time employment related to their vocational classes. Vocational Cooperative Training programs may supplement vocational classes in Distributive, Office, Trade and Industrial, Home Economics or Agriculture Education.

86.2 Program. In a Cooperative program, voluntary agreements are made between the employer, the school and the student, providing for legal employment at the legal minimum wages through an organized plan of training on-the-job. The employer periodically evaluates the student's progress on-the-job. Students in the cooperative program must have reached the age of 16 and employed no less than a total of 540 hours during the school year.

86.3 Facilities. Related vocational instruction for cooperative student-trainees is conducted in the facilities already provided for the vocational class in which the student is enrolled. Refer to the facilities and layout in this manual for the respective fields, Distributive, Office, Home Economics and Agriculture. For the cooperative training program for the Trade and Industrial occupations, however, the related instructional class would be a general classroom equipped with tables and chairs plus a storage facility in which cubicles are provided for the placement of individual job study assignments. These cubicles, enough for 25 persons, should be approximately 12″ wide, 15″ deep and 8″ high.

SECTION 87.0 HEALTH, PHYSICAL EDUCATION AND RECREATION

87.1 Scope. Facilities for a continuous program in health and physical education are required in grades 1–10, and should be provided in grades 11 and 12. These facilities are combined with recreational facilities to meet the needs for desirable school-community activities of this nature.

For basic development and details of physical education facilities beyond the scope of this section, reference should be made to the publication developed by educators in the fields of health, physical education, and recreation commonly referred to as The National Guide. It is titled "Planning Facilities for Health, Physical Education, and Recreation" and is published by The Athletic Institute, Inc., Chicago 4, Illinois.

87.11 Instructional Program.

a. In order to determine the instructional facilities necessary, local authorities, with the assistance of the physical education teachers and state consultants in the field, will need to establish a health, physical education and recreation program meeting local school and community needs.

b. Consideration must next be given to the following:

(1) The manner in which the program is to be organized.

(2) The number of boys anticipated in each year of the program.

(3) The number of girls anticipated in each year of the program.

c. In addition to these items, the following must be determined:

(1) The basic gymnasium plan and auxiliary units which will most efficiently house the program.

(2) The number and types of other spaces for intramural and extra-curricular games and sports, individual and dual activities, body conditioning activities, rhythmical and recreation activities.

(3) Number and types of outdoor areas with rigid specifications.

(4) Extent of participation in interscholastic activities.

(5) Accommodations for spectators, indoors and outdoors.

87.2 Teaching Stations. Physical education teaching stations required by all schools are (1) basic gymnasium, (2) auxiliary gymnasium (when an extra teaching station is needed), and (3) health classroom(s). Larger schools may provide special purpose teaching stations such as gymnastics room(s), wrestling room(s), rhythmical activities room(s), and swimming pool. Corrective rooms and locker rooms are not considered teaching stations.

Outdoor facilities are not considered teaching stations for scheduling purposes, but are, in practice, alternate teaching stations, subject to the weather and the local program for their instructional and recreational use.

Outdoor facilities should include: (1) hard surfaced multiple-purpose area, (2) football field, (3) track and field events area, (4) field game area, (5) baseball field, (6) horseshoe courts (optional), (7) apparatus area, (8) archery range, (9) tennis courts, (10) golf practice area, (11) general purpose area, (12) ice hockey area.

87.21 Number of Teaching Stations. A teaching station is a space of sufficient size to accommodate one teacher instructing one class group at a time. Sufficient teaching stations of the type needed for the subject should be provided to permit scheduling and such separation by grade and sex as is required for the program. Class size should be comparable to that of other subjects. A class size of 35 pupils is a desirable maximum.

Care must be exercised to establish firm data relative to: required and elective courses, class size, class periods scheduled per week, percent of teacher station utilization, etc. Teaching. stations for combined secondary and elementary schools should be calculated separately for secondary and elementary needs. See National Guide, Chapter 4, "Indoor Facilities" for detail on calculating teaching stations. The basic formula is:

$$\text{Number of Teaching Stations} = \frac{\text{Number of pupils enrolled in subject}}{\text{Desirable class size}} \times \frac{\text{Number of periods per week in subject}}{\text{No. of periods per week teaching station is available}}$$

The formula may be used for separate groups of boys, girls, and grades and the results added to get a total teaching station figure. This total will usually need adjustment to round out the facilities.

87.22 Example of Calculations. Junior High School enrolling about 1400 pupils:

a. For preliminary estimates: Enrollments—700 boys and 700 girls. Class size is 35. Physical Education classes for boys are scheduled 3 hours a week and for girls, 2 hours a week. This is a minimum program for girls and 1 additional hour over a minimum program of 2 hours for boys.

b. Using the basic formula:

$$\frac{700\text{ (boys)}}{35\text{ (class size)}} \times \frac{3\text{ (periods per week)}}{25\text{ (periods available)}} = 2.4\text{ Teaching Stations}$$

$$\frac{700\text{ (girls)}}{35\text{ (class size)}} \times \frac{2\text{ (periods per week)}}{25\text{ (periods available)}} = 1.6\text{ Teaching Stations}$$

Total Teaching Stations needed . . . = 4.0 Teaching Stations

c. The four teaching stations needed may be provided by a basic gymnasium, divided by a movable partition into 2 teaching stations and by an auxiliary gymnasium providing 1 teaching station. A swimming pool (very desirable in a junior secondary school) might provide the 4th teaching station.

87.3 Planning Teaching Stations

87.31 The Gymnasium Unit, Secondary Schools. (For Gymnasium Unit, Elementary Schools, see Section 56.)

Section

a. LOCATION. The location of the gymnasium unit should provide for:

(1) Minimum of noise interference with quiet areas of school

(2) Separate public entrance and public toilets

(3) Access to outdoor facilities, preferably without using the school corridors

(4) Locking off the gymnasium and service facilities from rest of school

(5) Convenient circulation to other parts of the school plant

b. DATA BASIC TO PLANNING. The size of official courts for indoor physical education activities:

Official basketball court, senior high school . .	50′ x 84′
Official basketball court, junior high school . .	42′ x 74′
Official volley ball court	30′ x 60′
Official court for badminton, paddle tennis, etc.	20′ x 44′
Recommended for circle game . . .	30′ diameter circle

87.32 Basic Gymnasium. This gymnasium, providing for both physical education instruction and interscholastic athletics, should accommodate an official size court 50′ x 84′ with a minimum clearance of 6′ at each end and 5′ on each side of the court. Additional space should be provided for telescopic bleachers, preferably recessed, on each side of the court to meet the needs of the community. The clear ceiling height should not be less than 22′, preferably higher if basketball backboards are raised for volley ball games. The entrance and location of the bleachers should be such that spectators will not have to walk across courts. Locate electric scoreboards, clocks, and lights for effective use and protect as necessary.

a. DIVISIBLE FLOORS. When it is necessary to divide gymnasium floors into two teaching units, these units should be not less than 60′ x 40′. Recommended size would be:

	Overall Inside Gym Dimensions	*2 Units each measuring:
Junior high schools:	65′ x 86′	65′ x 43′
Senior and combined high schools:	78′6″ x 96′	78′6″ x 48′

*Structural provision should be made for the installation of full height movable partitions to separate the gymnasium into two instructional areas. See Section 272.0 "Folding Partitions—Power Operated," for requirements of INDUSTRIAL COMMISSION OF MINNESOTA.

b. EQUIPMENT. Storage or mounting should be provided for the following equipment used in the gymnasium (as program indicated):

Basketball backboards and goals
Climbing ropes
Mats and mat trucks
Jumping standards and cross bar
Volleyball-badminton standards
Adjustable horse
Adjustable buck
Suspended parallel bars
Horizontal bar
Adjustable flying rings
Traveling rings
Three section stall bars and benches
Horizontal chinning bar, wall supported
Horizontal or wall adjustable ladder

Section

Vaulting box
Beat or spring takeoff boards
Adjustable parallel bars
Adjustable bar bell
Iron dumb-bells
Chest weights, wall
Scales with height measuring rod

c. FLOOR PLATES AND ANCHORS. Suitable floor plates and anchors for gym equipment should be installed when the floor is laid (anchored in the concrete base); also provisions for hanging and removing equipment normally attached to wall or ceiling.

87.321 Corrective Room. This auxiliary room is a part of the gymnasium teaching station and is used simultaneously with the gym for specialized physical education activities for those who cannot participate in the program offered the general student body. The room should be accessible from the gymnasium teaching stations. It should be not less than 30′ x 15′ with a 14′ ceiling height. While it is basically a remedial room, it may be equipped for such activities as gymnastics. Multiple use will affect the equipment and storage provided. Mounting and storage should be provided for the following equipment (as program indicated):

Climbing ropes
Mats and mat trucks (vertical or flat)
Adjustable parallel bars
Suspended parallel bars
Horizontal bar
3-section stall bar and benches
Horizontal or wall-adjustable ladder
Adjustable bar-bell
Iron dumb-bells
Chest weights (wall)
3-section mirror (6′ height)
Adjustable table or plinth
Scales with height measuring bar.

87.33 Auxiliary Gymnasium. This teaching station is usually provided when the basic gymnasium (with two teaching stations) does not provide sufficient teaching stations. The auxiliary gymnasium should be at least 40′ x 60′ with a minimum ceiling height of 18′. As a teaching station it will need locker room facilities for the class similar to those for the main gymnasium.

87.34 Swimming Pool

87.341 General. Swimming instruction and water safety are two important phases of the physical education program. An ideal situation would include swimming pools in new elementary, junior high school, and senior high school buildings. If pools can be included at only one level, the junior high school level should be given priority.

Where a swimming pool is provided, it may be counted as one of four or more teaching stations for physical education activities. This unit should be provided only after the major gymnasium unit and service facilities have been provided.

87.342 Reference. For reference to "swimming pools," refer to: (1) "Standards of the National Collegiate Athletic Association—Recommended Practices for Design, Equipment and Operation of Swimming Pools and other Public Bathing Places," published by the American Public Health Association, and (2) "Manual of Swimming and Wading Pool Sanitation," Minnesota State Department of Health, and (3) "A Guide for Planning the School and and College

Swimming Pool and Natorium," Wm. L. Terry, Institute of Field Studies, Teachers College, Columbia University.

87.343 Legal Requirements. No contract for the construction, alteration, or enlargement of any swimming pool may be let until the plans and specifications have been submitted in duplicate to the School Building Planning Section, State Department of Education, and also approved by the State Department of Health. Mechanical equipment and facilities for the purification of pool water by filtration and sterilization must be provided.

87.344 Location. The swimming pool unit should be located adjacent to the gymnasium classes. If a community program is planned, separate locker and shower facilities are recommended. The locker and shower facilities and the pool should be on the same level.

87.345 Design

a. Size. The minimum size pool recommended is 35′ x 75′. The standard size for competitive records is 45′ x 75′—1″, with six swimming lanes, each 7′ wide, and with 1½′ clearance for each outside lane.

b. Depth. The depth should be designed to provide shallow spaces for the swimming instruction program and deep spaces for diving purposes. Usual depths are a minimum of 10′ at the diving end and minimum of 3′-6″ at the shallow end. At least half of the pool should be not over 4′-6″ deep.

Note: The pool floor should be above the grade level of the ground.

c. Ceiling Height. The clear ceiling height from pool platform to finish ceiling should be 16 feet for low boards (1 meter) and 23 feet for a 3-meter board. Refer to Recommended Standard Distances for a Diving Facility (obtainable from State Health and Physical Education Unit, when checking ceiling heights.

d. Heating and Ventilation. Facilities for heating the swimming pool area to above 80 degrees F. (at the thermostat) and for its positive ventilation should be provided. See Table 241.1. The air should be humid rather than dry.

e. Electrical. For approved method of bonding reinforcing structural steel members of swimming pool, see Section 271.1; for approved method of grounding metal diving platforms, boards, and ladders, see National Electric Code Sec. 680.5.

f. Lighting. Light fixtures used in this area must be vapor proof, easily accessible, or easily lowered for relamping. Provision must be made for adequate lighting of the deep end of the pool, either from overhead or underwater. (For underwater lighting 100 lumens per sq. ft. of pool surface). See Table Sec. 193.3. Lights should be installed over the pool, not on walls, to eliminate reflections. Underwater lighting is recommended as a safety factor.

g. Sound Treatment. It is essential that this unit be treated for sound absorption, using mineral materials that will not disintegrate from moisture.

h. Spectator Space. Where provided, should be completely separated from the plunge area or pool floor. Where there is a limited deck area a flat deck should be provided, using portable bleachers for spectators and an 8″ curbing

between pool and bleachers. This will make the entire swimming pool area more functional for instruction.

i. Other Detail

(1) Special attention should be given to any glass area and to ceiling and wall construction because of condensation. Windows or skylights are not recommended because of glare, condensation and heat loss.

(2) The walls of the pool unit should be constructed of glazed block or a similar impervious material to at least a height of 6′-6″.

(3) Glazed block, ceramics tile, or a similar impervious material should be used for the floor and sides of the pool. On ends and sides of pool this should be a non-slip material, 3 feet down.

(4) All surfaces around the pool should be of non-slip ceramic tile sloped to drain away from the pool.

(5) The use of wood and metal strip in this area should be reduced to a minimum. Where used, metal should be non-rusting and non-corrosive. Stainless steel or chrome plated metal would be suitable.

(6) For access to pool, swimmers should pass through the shower room.

(7) Re-circulation of pool water should be at least 50% through the gutter drains.

(8) There should be capacious gutters on all four sides of the pool.

(9) Diving equipment installed should be of the standard recommended by the NCAA Rules Committee for Swimming.

(10) Tile color of the pool should be white with black markings.

(11) Guidelines on the pool bottom should stop in a "T" at least thirty inches long and ten inches wide, approximately 5 feet from the end wall. This "T" will serve as a warning to swimmers of the approaching turn, but the line should begin again on the end of the wall and continue up to the surface of the water. This method of marking will enable a swimmer to distinguish between the bottom and end wall and thereby facilitate turns and prevent injuries.

The end wall should have individual, contrasting turn areas or targets of non-slip tile, thirty inches wide, extending completely around the pool, so that classes working on pool-width exercises have sure footings for push-offs.

(12) At least one water proof electric outlet should be located on each side wall, preferably more.

(13) A source of hot and cold water should be provided on the deck for maintenance.

(14) Chalkboard and bulletin board should be provided in pool area; also, provision for public address system, microphone, and record player outlets.

87.35 **Health Classroom.** The health classroom, which also may be used for safety and classroom driver education groups, should be located near the Physical Education Unit. It should have the size and general characteristics of a general classroom, including chalkboard, tackboard, movable storage cabinets, and provision for the use of audio-visual aids. It should be equipped with a teacher's desk and science demonstration desk, with ample storage space for health, first-aid and safety. In large schools, the health classroom may be oversize to accommodate up to 70 pupils in large group instruction and be divisible for smaller group instruction.

87.4 Planning gymnasium Unit Service Facilities. The following gymnasium service unit areas should be provided:

a. Service Areas—Boys

- (1) Locker and dressing
- (2) Shower room
- (3) Clean towel storage, issue
- (4) Wet towel collection
- (5) Equipment storage, issue
- (6) Office(s)

b. Service Areas—Girls

- (1) Locker and dressing
- (2) Shower room
- (3) Clean towel storage, issue
- (4) Wet towel collection
- (5) Equipment storage, issue
- (6) Office(s)

c. Team Service Areas

- (1) Lockers
- (3) Showers, toweling—may be same as physical education service areas
- (3) Storage and issue of equipment
- (4) Drying room—uniforms, football gear
- (5) Small training room (optional)

d. Outdoor Heavy Equipment Storage

- (1) Boy's field area.
- (2) Girl's field area.

87.41 Locker-dressing Room. Locate on the gymnasium floor level, directly adjacent to and connected with the gymnasium floor.

a. Access. Locker rooms should have a corridor entrance and a direct entrance from outside, as well as the gymnasium access. Design so that persons outside cannot look in.

b. Size. Each locker-dressing room should have a floor area of approximately 24 sq. ft. per pupil, based upon the largest number of pupils using the locker room at any one period of the day, including football practice.

c. Lockers.

(1) Storage lockers for gym suit and shoes should be provided in each locker room, one for each pupil enrolled in the total physical education program, based on ultimate enrollment.

(2) Dressing lockers should be provided in each dressing room area sufficient to accommodate the largest number of pupils using the dressing room at any one period of the day, including pupils in gymnasium teaching stations; pupils in activities in any other teacher station such as wrestling, gymnastics, swimming; and pupils in any extra-curricular, intramural or athletic activities not provided locker-dressing space elsewhere.

Note: The smallest secondary school should have at least 40 dressing lockers.

(3) Locker units. Consult the National Guide for types of standard combinations of storage and dressing lockers. Storage lockers with heights of 12″, 15″, 18″, 24″ may be assembled in tiers and combined with full 60″ or 72″ dressing lockers to match 60″ or 72″ heights. Maximum heights for locker tiers in junior high schools is 60″. Lockers should be of steel, as fully ventilated as possible, with serial number plates, pre-locking device, and padlock attachment.

(4) Locker location. All lockers possible should be placed on the perimeter of the locker-dressing room. Lockers which cannot be located on the perimeter, when placed face to face, should be at least 8′ apart, permitting two rows of dressing benches, 30″ from bench to locker. Benches should be secured to floor; seatboards of hardwood, 8″ in width; height of benches 16″ for secondary schools, 15″ for elementary schools.

(5) Lockers should be set on a 4″ to 6″ raised, coved; concrete base.

d. Toilets and Lavatories. For a maximum class size of about 40 pupils, the following are recommended: boys—2 water closets, 3 urinals, and 2 lavatories; girls—3 water closets and 2 lavatories.

e. Service Sink. A janitor's closet with a recessed service sink with little or no curb and space for mops, pails, and detergents should be provided convenient to each dressing room. There should be a hose bibb on the service sink or a recessed hose bibb provided convenient to the dressing and shower rooms.

f. Drains. Floor drains should be provided in each dressing and shower room and are desirable in toilets in this area.

g. Walls. Walls should be of materials resistant to moisture absorption with smooth, easily cleaned surfaces, all corners rounded.

h. Floors. Locker room floors should be of impervious, water-proof materials, such as ceramic tile or terrazzo, with a non-slip finish. Concrete floors, if used, should be treated with a hardener. The base in locker-dressing rooms should be coved and of the same material as the floors.

i. Mirrors. Girls: provide full length mirror at one end of each locker row. Boys: provide overhead, angled mirror, located so as not to interfere with circulation. Locating mirrors above lavatories is not recommended.

87.42 Shower Rooms

a. Boys. All showers for boys should be gang-type; at least one shower head for each 4 boys in the maximum size class.

b. Girls. For girls, about 90 percent of the showers should be gang-type and about 10 percent be individual showers in stalls with dual dressing booth cubicles. For gang-type showers, provide one shower head for each 3–4 girls.

c. Shower Heads and Temperature Controls. Shower heads should be tamper proof, swivel type and recessed, with individual controls for gang showers. There should be a temperature control and master cut-off valve outside the shower room for instructor operation. Exposed plumbing in the shower rooms should be kept at a minimum. Water temperature should not exceed 120 degrees F. at any shower head.

d. Floor Area. A minimum floor space of 12 sq. ft. per shower head should be provided plus space for circulation. Minimum width of shower rooms with heads on opposite walls should not be less than 9′-6″; heads on one wall only, 6′-6″.

e. Soap Supply. A sturdy soap dispenser or outlet should be located at valve height between every other shower head. The liquid soap outlets should be supplied from a central reservoir of sufficient size to accommodate at least a day's supply of soap, or a central supply tank holding several days' supply.

f. Floors should be of non-slip, waterproof materials, such as ceramic tile or terrazzo, sloped toward drains. Base should be coved of same material. Design floors so that entrance curbs are not needed.

87.43 Towel Service. Towel service offered by schools is desirable and is found in the great majority of schools.

a. Towel Storage and Issue Room. A small room, about 80–100 sq. ft. for storage and issue of clean towels should be provided. It should be located so that towels can be issued to pupils as they leave the showers. A lockable dutch door with counter will permit easy issue of towels and protection when not in use.

b. Soiled Towel Ares. Provision should be made for a soiled or wet towel storage area located adjacent to the exit from the body drying area. This may be a space for carts with duffel bags or arrangement of hooks on wall to which duffel bags for laundry may be attached.

c. Laundry Room. School laundry service is recommended as ideal. A well ventilated room, about 200 sq. ft., may be located adjacent to the locker-dressing room and equipped for this purpose.

87.44 Storage Areas

a. Gymnasium Storage Areas. These rooms should be on the gymnasium floor level directly accessible from the gymnasium proper. In divided gymnasiums, equipment storage rooms should be provided adjacent to each teaching station area. Large or double doors should be provided between storage area and gymnasium to facilitate moving large equipment. Space should be large enough to accommodate mats, gymnastic apparatus, volley ball and badminton standards, projectors, record players, record storage cabinets. The minimum area needed is 250 to 300 sq. ft. for each teaching station.

(1) In season supply and check-out should be provided for storage of all equipment and supplies during season of use. Off season storage should accommodate all non-seasonal new and reserve equipment and supplies. Counters, bins, shelves, cabinets, rods, and movable carts are needed. In the off-season storage area, a work area, work bench, and work table with a vise and tool drawers is needed.

Storage facilities should be so planned as to facilitate separate storage areas for physical education and the athletic team.

(2) Space. Provide in both boy's and girl's service units:

Boys: equipment issue and storage . . . about 500 sq. ft.
Girls: equipment issue and storage . . . about 300 sq. ft.

c. Outdoor Equipment Storage Areas. One such area should be immediately accessible to the football and track areas and adequate to house the equipment used in these areas.

Another such storage area should be adjacent to the girl's field area and adequate to house such items as archery targets, softball bases, etc. Targets and outside maintenance materials could share the same facilities.

87.46 Offices. Locate so as to provide supplementary supervision of the shower and dressing areas.

a. Boy's Unit. For office area (divisible) provide about 100 sq. ft. per staff member (300–500 sq. ft.) with separate areas for physical education staff and coaches. Equip with:

Desk and chair for each teacher or coach
File cabinet for each teacher or coach
Bookcases, lockable cabinet, and shelving
Medicine cabinet; waste container
Chalkboard and tackboard
Telephone
Instructor's shower, toilet and dressing (in or adjacent to area).

b. Girl's Unit. Office area for two instructors, including instructor's shower, toilet and dress, will require about 200 sq. ft. of floor area. Equip with:

Desk and chair for each teacher
File cabinet for each teacher
Bookcases, lockable cabinet, and shelving
Medicine cabinet; waste container
Chalkboard and tackboard
Telephone.

87.5 Service Facilities for Athletic Programs

87.51 Team Room

a. Size. Should provide space for lockers and benches for largest athletic group—600 to 1000 sq. ft. for 60 to 100 pupils, plus space for shower heads, drying and toilet.

b. Equipment

Sufficient 15″ x 15″ x 72″ lockers for team squad
Benches fastened to floor
Angled overhead mirror(s)
Chalkboard (8′–10′)
Tackboard (6′).

87.52 Supply Room. Should be adjacent to dressing room; for storage of new and out-of-season athletic clothing and equipment. May be an area in the physical education Equipment Issue and Storage Room. Provide:

100 to 200 square feet of floor space
Shelving, bins, cabinets, rods, movable carts as needed
Adequate ventilation.

Section

87.53 Drying Room for Athletic Clothing. Locate adjacent to dressing room. Should contain at least 200 sq. ft. of floor space. Provide special ventilation. Equip with perforated metal shelving and metal pipes for hanging athletic clothing; also metal hooks and hangers, arranged so that air can circulate through clothing.

87.54 Training Room (optional). An area of about 200 sq. ft. will provide space for:

Training cabinets; table style with drawers, shelves and metal containers
2—tables: 4′ x 6′ x 32″ high
One cabinet for supplies; lockable; about 6′ high, 8′ wide and adjustable 18″ deep shelves
Hand wash basin or sink
Hydrotherapy tank—permanent
One or two—2′ adjustable infra red lamps.

87.55 Office. See Section 87.46.

87.6 FOUNTAINS AND CUSPIDORS. Recessed drinking fountains and cuspidors should be provided at both ends of the main gymnasium and at one end of the auxiliary gymnasium, corrective room, and in the locker room. Fountains in main gymnasium should be accessible when bleachers are open. Drinking fountains should also be provided in other appropriate areas, such as the lobby area and outside activity area.

87.7 UTILITIES AND OTHER DETAIL

87.71 Heating and Ventilation. The heating and ventilation system should be arranged so that the gymnasium unit can be heated and ventilated independent of the rest of the building. Adequate exhaust ventilation is necessary to remove vapor in the shower and adjacent areas. See Section 241.1 for other desirable heating and ventilating conditions.

87.72 Electrical. Provide:

a. OUTLETS. One outlet at the front and one at the rear of each health classroom; one at the instructor's desk or demonstration unit in the health room; adequate outlets in the main gymnasium to permit the use of public address system, electrical scoreboard, record player, projectors; adequate outlets for auxiliary gymnasium; adequate outlets for cleaning, waxing and polishing.

b. LIGHTING. See Section 193.3 for recommended average maintained foot candles for gymnasium, locker-dressing rooms, shower rooms, team rooms, toilets, etc.

Provide moisture proof light fixtures in shower, locker room and toilets; guards on all light fixtures and thermostats in gymnasiums and corrective rooms.

NOTE: Guards should be wire to catch broken lights or globes. Gymn lights should be recessed flush with ceiling and not hang on pipes that drop down. Light switches must not be located in shower rooms.

87.73 Audio-Visual. Install black-out facilities in each health classroom and in combination units such as gymnasium-auditoriums.

87.74 Sound Conditioning. See Section 177.

Section

87.75 Windows. When provided in gymnasiums, windows should be the awning type that can be opened in rainy weather, with devices for operating sash at height and location that present no hazard to pupils. Do not locate windows above basketball backstops.

PROVIDE any windows or sky-lights located where they might be broken with wire reinforced glass. HEIGHT of windows, if provided, should be not less than 12′ for senior and junior high school gymnasiums and 8′ for elementary school activity rooms or gymnasiums.

87.76 Floors, Gymnasiums and Activity Rooms. Floor should be resilient and non-slip. Hardwood floors (maple) recommended. When floors are laid over sleepers, provide adequate sub-floor ventilation. At walls, allow space for expansion and contraction. Sub-floors and sleepers over concrete should be treated to prevent damage by termites and dry rot. Floor under sleepers should be insulated from ground temperature and a vapor barrier provided.

87.77 Other Suggestions

(1) Eye bolts provided in each corner and along the walls of the gymnasium during construction are useful when decorating for school parties. They must be installed a safe height from the floor.

(2) When use of equipment is planned which will require fastening to the wall or floor, a layout of its placement should be made so that structural provision can be made for wall boards, floor plates, etc.

(3) Lines outlining the game areas and court should be painted in differentiating colors on gymnasium floors before finish coat is applied.

87.8 GYMNASIUM-AUDITORIUM. In small secondary schools where a gymnasium-auditorium may be provided, this unit should be basically designed as a gymnasium. Folding bleachers should be placed on the long axis of the room with the stage facing the bleachers. An adequate chair storage room for movable chairs should be provided adjacent to and connected with the gym floor.

87.9 OUTDOOR FACILITIES

87.91 Basic Factors

a. COOPERATION WITH RECREATION AUTHORITY. In planning outdoor facilities it should be borne in mind that the school has a major responsibility of providing for the physical education needs and interests of pupils during the school year, and may make in cooperation with the local recreation authority, provision for the recreation needs of these pupils after school hours and during vacation periods, and for the recreational needs of the community.

b. SIZE. The size of the outdoor facilities area is dependent on (1) the program to be offered and (2) the number of pupils using the facility during periods of peak load.

c. OFFICIAL AND RECOMMENDED SPACE. In addition to the regulation areas required by official rules, most games require some necessary space around the exterior borders of the playing area. The regulation dimensions for the various activities, together with the overall areas that should be set aside for the provision of these activities, are stated in

Section

Sec. 87.94 "Space Requirements for Games and Sports for Secondary Schools." Check on any revisions to regulation game areas required by official rules with Minnesota State High School League, 829 Plymouth Building, Minneapolis 2, Minnesota.

87.92 Specific Areas for Secondary Schools

a. Hard-Surfaced Multi-purpose Area. This all-weather area should be laid out with minimum dimensions of 100′ by 120′. It provides for many court activities such as basketball, badminton, tennis, shuffleboard, etc., which require hard, smooth playing surfaces. Basketball and tennis standards should be set in the hard-surfaced area.

Hard-Surfaced Outdoor Hockey Station. If a hockey program is to be provided, space for a hockey station should be located adjacent to the gymnasium with dimensions of 125′ x 200′ (official rink size 85′ x 185′). Provisions should be made so that it may be covered with a roof structure at some future date, adding to the physical education department an all weather teaching station.

b. Football Field. The dimensions recommended for laying out a football field are 190′ x 420′. Since most of the play is lengthwise of the field, it is desirable to have the long axis extend northwest and southeast, forming an angle of about 45 degrees from the north, to avoid glare from the sun. If spectator stands or bleachers are to be provided on one side of the field, they should be located on the west side. The football field should be crowned in the center. This area may be used for other physical education activities.

c. Track and Fields Events Area

(1) **Running Track.** A one-fourth mile track is recommended. General practice is to locate the track around the football field. The width of the straightaway should be 23′ (6 lanes of 42″ plus 1′ on each side). The straightaway should be the west side and should be extended to a minimum straightaway distance of 700′. The width of the oval should be 19′ (6 lanes of 36″ plus 1′ on each side). The radius recommended for the inside curve of the track is 110′ with a true semi-circle for the curve. The space required for laying out the oval of a one-quarter mile track is approximately 26′ x 590′ with additional space required for the extended straightaway. The sides of the track should be a minimum of 25′ from the sidelines of the football field.

(2) **Jumping Pits.** For high jump, broad jump, pole vault, step-jump, separate pits with runways should be provided. One set of these pits should be located inside the running track in the semi-circular area near one end of the field or between the side of the football field and the track. A second set of these pits is desirable in the field areas close by.

Recommended dimensions:

Item	Width	Length	Length of Runway
Broad jump pit . . .	10′	22′	125′ to take-off board
Pole vault pit	16′	12′	100′
Hop step and jump . .	10′	22′	125′
High jump	16′	10′	50′

Section

Shot Put and Discus. Weight throwing and other field events of this nature are usually located on the football field or in the semi-circular area near one end of the field. Approximate dimensions needed for the shot put are 100′ x 100′. Shot and discus circles should be concrete.

d. Field Game Area. An area with dimensions of approximately 200′ x 400′ should be laid out in order to provide for maximum participation in such large space games as field ball, field hockey, touch football, soccer, speedball, softball, etc. This area may also be used as a practice field for football. Fields, backstops, and goals for the various games should be laid out in such a way as to permit overlapping use of the area during different seasons.

e. Baseball Field. An area with dimensions of 350′ x 350′ is recommended for laying out a regulation baseball field. This area allows for a minimum distance of 60′ from home plate to the bleachers or backstop. Best results are secured when the home plate is located in the southwest portion of the field, although some authorities favor the northwest section. East or southeast corners should be avoided. The baseball field may overlap other playing areas. However, it is desirable to avoid overlapping the skinned area of the infield with any other play area. Care should be taken to keep the running track out of range of batted balls.

f. Horseshoe Courts (Where program involves the community). A battery of five courts is recommended. A space of approximately 60′ x 80′ will be necessary. Courts should be located so as to avoid any cross traffic.

g. Apparatus Area. Where program includes an outside apparatus area, a space approximately 25′ x 100′ may be set apart for such equipment as chinning bars, vaulting bars, parallel bars, horizontal ladders, climbing ropes, etc. This space should be located near one end of the playground and in such a way as to eliminate cross traffic through the area.

h. Archery Range. An archery range which would provide for a maximum shooting distance of 50 yards will require an unobstructed area approximately 90′ x 225′. This will provide sufficient space for 3 to 4 targets spaced 5 yards apart, and a clearance space of about 10 yards on each side of the range, measured from outside each end target. In general practice, targets may be only three yards apart.

i. Golf. A practice green or turf area of approximately 100′ x 100′ is recommended for short approach shots, putting, and such games as clock golf, croquet golf, and miniature golf.

j. General Purpose Area. A turf or black top area of approximately 100′ x 200′ should be set aside for games of low organization, informal activities and free play.

k. Tennis. Approximately 18,000 to 27,000 sq. ft. may be set aside for four to six tennis courts 45′ x 100′ (36′ x 78′ and clearance: 10 feet beyond side lines or adjacent courts; 15′–18′ behind base lines). Tennis courts should be enclosed with woven wire fencing 10′ to 12′ high, 2″ mesh if heavy hard wire, or 1½″ mesh if soft, light wire.

Specific Areas for Elementary Schools. See Section 56.

87.93 Combined Secondary and Elementary Schools.

When facilities are planned for combined secondary and elementary schools, the elementary facilities should be sepa-

Section

rated from the high school facilities and be located nearer the building. When not being used by secondary school pupils, some of the facilities planned for high school use may be used by the elementary children. Use of these facilities at the same time is not desirable.

Section

87.94 Space Requirements for Games and Sports for Secondary Schools. The following table gives official dimensions for the various games and sports, and shows the overall areas which should be set aside for the inclusion of these activities in the school physical education, intramural, and interscholastic program.

Sports Area	Official Dimensions (in Feet)	Recommended Dimensions (in Feet)	Space Required (in Sq. Ft.)
Hard Surface Multiple Purpose Area (the following sports may be played in this area)		100 x 120	12,000
Badminton	20 x 44		
Basketball	50 x 84		
Deck Tennis	18 x 40		
Hand Ball	20 x 34		
Paddle Tennis	20 x 44		
Shuffleboard	6 x 52		
Volleyball	30 x 60		
Tennis	36 x 78		
Track (one-fourth mile) and Field Area:	208 x 538	260 x 590	153,400
Football and other large area games	160 x 360		
Field Games Area (may be used for:)	—	200 x 400	80,000
Fieldball	180 x 300		
Field Hockey	180 x 300		
Six-man Football	120 x 300		
Soccer	225 x 360		
Softball	275 x 275		
Speedball	160 x 360		
Touch Football	160 x 360		
Baseball	310 x 310	350 x 350	122,000
Horseshoes	10 x 50	60 x 80 (5 courts)	4,800
Apparatus	—	25 x 100	2,500
Archery (minimum of 3 targets)	50 x 175	90 x 225	20,250
Golf	—	100 x 100	10,000
General Purpose Area	—	100 x 200	20,000
Tennis (six courts)	36 x 78	45 x 100	27,000
TOTAL AREA			451,950 (Approx. 10 Acres)

Section

87.95 Outdoor Physical Education, Intramural, and Recreation Areas for Secondary Schools of Various Enrollments. The following table represents the number and variety of such areas that may be provided by secondary schools of various size enrollments.

Number of Pupils	400	600	800	1000	1200	1400
Types of Areas:						
Multiple Purpose (100 x 120)	1	1	1	2	2	2
Track and Football (260 x 590)	1	1	1	1	1	1
Field Games (200 x 400)	1	1	1	2	2	3
Baseball (350 x 350)	1	1	1	1	1	1
Horseshoes (60 x 80)	1	1	1	1	1	1
Apparatus (25 x 100)	1	1	1	1	1	1
Golf (100 x 100)	1	1	1	1	1	1
General Area (100 x 200)	1	1	2	2	4	4
Tennis Courts (45 x 100)	0	0	2	2	4	4
Archery (90 x 225)	1	1	1	1	1	1
TOTAL ACREAGE#	9.6	9.6	10.5	12.6	13.8	15.6

#For recommended *total site area* see Section 42.

Section

87.96 Fencing Playing Fields. All playing fields should be enclosed with fencing 6′ high.

SECTION 88.0 DRIVER EDUCATION

Section

88.1 Goals. In general, these are:

(1) To know and understand the Minnesota Statutes and the rules and regulations of the Highway Department of the State of Minnesota concerned with owning and operating an automobile and being a pedestrian on the public highway.

(2) To develop the attitudes in driving which have been shown by experience to minimize traffic accidents or difficulties.

(3) To learn the skills and techniques needed to operate a motor vehicle on the public highways efficiently and safely.

88.2 Activities. These involve:

(1) Classroom instruction in driver education.

(2) Behind-the-wheel instruction in a dual controlled training car.

(3) Laboratory instruction, utilizing a driver-trainer or simulator unit. (Optional—desirable in large schools.)

88.3 Driver Education, Minimum Requirements (New "driver education laws" passed by the State Legislature may change these requirements.)

a. Classroom Instruction. At least 30 class periods' 55 minutes in length. Should precede behind-the-wheel instruction by not more than three months.

b. Behind-the-Wheel Instruction. At least 6 hours of behind-the-wheel practice driving. Should follow classroom instruction by not more than three months.

Note: The Driver's License Section, Division of Safety' Minnesota Highway Department may issue an "instruction permit" to any applicant who is at least 15 years of age and who is enrolled in an approved driver education program. (Laws 1963 Chapter 382, Sec. 2—amending M.S. 1961 Section 171.05 Subd. 1 and adding Subd. 2.)

(1) If a driver-trainer unit is used, at least 12 hours per pupil with the driver-trainer unit and 3 hours per pupil of on-the-street and highway driving.

(2) When a driving range is used, at least 10 hours of practice driving on the range with a minimum of 2 hours per pupil devoted to on-the-street and highway driving.

Section

c. Grade Placement. Classroom driver education should preferably be given in the 9th grade, with behind-the-wheel instruction given either during the summer months between the 9th and 10th grades or the first semester of the 10th grade. It may be offered, as well, to pupils in the 11th and 12th grades who did not take the course in the 9th or 10th grades.

88.4 Trends. There is a trend toward:

(1) Large pupil groups for lecture and testing. These groups may be 60 or more pupils.

(2) Small laboratory groups for special laboratory activities, discussion and individual help.

(3) Use of driver-trainer or simulator laboratory units to create a superior teaching situation for some phases of driving practice and to reduce time in dual controlled cars and so reduce road hazard exposure.

88.5 Facilities

a. Classroom Driver Education. The regular health and safety classroom will normally provide space for driver education instruction. In large schools this may be an oversize classroom divisible for small group instruction.

b. Driver-Trainer Instruction. An area of about 500 square feet will provide space for a 12-station driver-trainer unit.

88.6 Orientation

a. The driver-trainer laboratory and the driver education classroom should be adjacent to each other with an access door between.

b. The driver education area should be readily accessible to the driving range and to the main traffic routes.

c. A driving range should be provided on the site and provision made for it in the initial site planning. For layout, consult with the state supervisor of Health and Physical Education, State Department of Education.

d. A reserved parking area should be provided for the dual controlled cars near the driver education area and with access to the driving range and main traffic routes. This may be in the parking area adjacent to the outdoor physical education fields.

89—99 Reserved for future use.

SECTIONS 100-109. CENTRAL AND AUXILIARY FACILITIES

SECTION 100.0 THE ADMINISTRATIVE UNIT

Section

100.1 Scope. The school administration unit influences the effectiveness with which the staff is able to operate a school. It also creates the environment in which patrons of the school will conduct their personal business with school officials. It becomes an important factor in the operation of the school and the public relations of the school with the community.

100.11 Administrative Functions and Activities

a. Among the primary functions of general administration are:

Providing effective leadership.

Rendering services to teachers and pupils.

Promoting school and community relationships.

Keeping records and accounts of pupils, property, budget.

Plant program and amagement.

Supervising the total program of the school.

b. Pattern of assignment to administrator or delegated to assistant administrator:

Administrator:	**Administrator or Assistant Administrator:**
Staff utilization	Daily program schedule
Classroom utilization	Transportation
Curriculum development	Teacher coverage and substitute teachers
Programming use of facilities	School lunch supervision
Educational research	Pupil accounting, assemblies, activities
Budget and supplies	Supervision of grounds and custodians
Supervising the instructional program	Safekeeping of records
Public relations	

c. Characteristic activities related to functions listed:

General office work; record keeping, filing, bookkeeping, stenographic and clerical work (possibly data processing.)

Pupil registration, scheduling and pupil accounting.

Ordering, handling, and inventorying of books and supplies.

Storage of office materials, equipment, records.

Conferences with parents, teachers, pupils, committees.

Communications, in and out of school.

100.12 Administrative Spaces. Desirable spaces in the administrative unit to implement the performance of these functions and activities:

Public reception space.

General office and work area.

Safe storage for money and records.

Administrative and personnel offices.

Conference room.

Storage and duplicating spaces.

Staff personal storage and toilets.

Communications center.

Data processing space (optional).

Section

100.13 Minimum Administrative Spaces, Small Schools. Every secondary school, every combined elementary and secondary school, and every elementary school with six or more classrooms should provide as a minimum: public reception space, general office space, administration office, storage for books and supplies, and a storage vault or safe with at least a two-hour fire resistance rating for safe keeping of school records.

All elementary schools with three or more classrooms should have an office and storage room unless they are in connection with a secondary school having adequate administration spaces.

100.2 Planning the Administrative Unit. Informality rather than formal arrangement should be a keynote in planning the administrative suite, equipment, and furniture layout.

a. Location. The administration unit should be located:

On the main entrance floor.

Convenient to but separate from the guidance and health service spaces and to all general use facilities.

Secluded from outside and corridor noises.

Where expansion of the office space can be economically provided.

b. Orientation to Pupil Personnel Area. The administration area may include or will have adjacent or near to it a pupil personnel area providing facilities for guidance and counseling, health service, and such services as those of psychologist and school social worker on a permanent or field basis.

In small secondary schools, up to 300 pupil capacity, the guidance and health areas are usually integrated into the administration area.

100.21 Public Reception Area. The waiting space should open directly into a public corridor or passage. Separation from the corridor by a glass partition is desirable. It should be separated from the general office area by a service counter. Circulation should be planned to facilitate access to staff mailboxes, administrator's office, service counter, bulletin board and communication center. The waiting area should be equipped with lounge furniture and a display surface (about 4′ x 6′). The size of the reception area will vary with the size of the school and administrative policies. See Table 100.3 for suggested floor area.

Mailbox. A mailbox, serviceable from both sides, should be provided in the public area. A cubicle about 9″ wide, 3½″–4″ high, and 13″ deep, with blank nameplace, should be provided for each teacher and member of the administrative staff. One open space for packages, about 36″ long by 10″ high by 14″ deep is desirable. A mail chute, exterior to general office, is desirable for deliveries when school is closed.

100.22 General Office Area. The general office area should be adjacent to the public space and directly accessible to the administrator(s) office(s), fire-resistant storage vault and office storage. Space for the following should be provided behind the service counter:

- Public receptionist's desk and chair, with typewriter stand, switchboard and other intercommunications devices (large school).
- General office work and clerical space with the necessary furniture and equipment.
- Work counter for duplicator equipped with hot and cold water, providing enough work space to handle and assemble the duplicated materials. For noise elimination, a separate duplicating room may be desirable. See 100.3 for suggested floor area.
- Program clock, central fire alarm system, communications center.

Service Counter. A flat top service counter should be provided to separate the office area from the public space with gates or openings for effective circulation. It should contain drawers and adjustable shelving on the office side, and toe space on both sides. Height should be 36″ to 42″ for adult or secondary school use. Elementary and combined schools should have a section of the counter 32″ high for elementary pupils.

Key Case. Unless a key file is provided, a key case, preferably recessed, should be provided in the general office or reception room. It should have ample room for all keys, space for identification, and be lockable. Some schools prefer the key case in the school vault, under the principal's direction.

Space. See 100.3 for approximate areas for different sizes of schools.

100.23 Administrative and Personnel Offices

a. Superintendent's Office. When the central administrative offices of a large school system are housed in a secondary school, the superintendent's suite may be separated from the office of the principal of the building by a corridor, lobby, or isolation in a wing of the building. In most schools separation by a conference or board room or the general office area is sufficient. Desirable features of the superintendent's office:

- Should be private but accessible.
- Open directly into the public waiting room, general office and corridor.
- Be large enough for small conferences—from 120 to 200 square feet according to the size of the system. See 100.3.
- Be conveniently available to the administrative staff.
- Furnished with desk, comfortable chairs, two drawer filing cabinets, adjustable bookcases, a section of chalkboard about 4′ x 6′, a section of tackboard about 4′ x 6′, a telephone and clock, a coat and storage closet, and a microphone connection to the public address system.

b. Assistant Superintendent. Provide the same general features as for the office of the superintendent. In large school a separate reception area and space for a secretary is desirable. See 100.3 for suggested floor area.

c. Principal's Office. Should provide the following features:

- Direct access to general office, waiting room and corridor.
- Readily accessible to staff, pupils, and public.
- In large schools have separate reception area and space for secretary.
- Enclose an area of about 150 square feet.
- Be furnished with: desk and chair, two-drawer filing cabinets, some conference chairs, adjustable bookcases, section of chalkboard and section of tackboard, clock, telephone, coat and storage closet, and microphone connection to public address system.

d. Assistant Principal's Office. Should have a private office with access to general office and principal's office. Should be similar to the principal's office in size, arrangement, and furniture.

e. Offices for Additional Personnel. Offices for additional administrative personnel may be needed or desired, such as:

- Guidance unit. See Section 101.
- Health center. See Section 102.
- Attendance office, convenient to general office.
- Supervisory personnel, in large systems.

f. Secretarial Area. In large schools with administrator and assistant administrator, a common reception area may be located between the two offices, convenient to the public reception room. The reception area should be large enough to accommodate four to six persons. The secretarial area should provide space for one or two secretarial work areas, each to include a secretarial desk, filing cabinets, and shelf storage.

100.24 Conference Room. A small conference area for department meetings, small groups, citizen's committees, should be provided adjacent to the principal's offices. The room should be furnished with a large table capable of seating eight to ten people. A coat closet and access to a toilet is desirable. In small schools this room may serve as a student activity room. For suggested floor area, see 100.3. In a building housing the superintendent's office, the room may be a combination board and conference room.

100.25 Staff Toilets and Personal Storage. A toilet room for each sex should be provided, easily accessible from all areas of the administrative unit. The men's toilet should have one water closet in enclosed stall, one urinal and one lavatory. The women's toilet should have one or two water closets in enclosed stalls and one lavatory.

Coat Closet for Staff. A coat closet or lockers should be provided for the office staff. If a coat closet is provided, it should have space for visitor's garments if located in the reception room.

100.26 Storage

a. Fire-resistive Vault. The size and type of the fire-resistive storage should be determined from a study of the filing system best adapted to the school—kinds of records and manner of storing, such as scholastic, health and financial records, on shelves, in stationary or rolling files, or microfilm storage of records of graduates. See 100.3 for suggested floor areas. See NFPA No. 232 for design of fire-resistant storage. Each school with six or more classrooms should be provided with a fire-resistive vault or safe.

See Section 101. Guidance Unit for description of a central storage room of fire-resistive filing cabinets easily accessible to general office and guidance personnel.

b. Supply Storage. The space needed will vary with the size of school and administrative policies. Generally, adjustable shelves, drawers and cabinets will provide for such items as office supplies, forms, arts and crafts materials, rolls of newsprint, large size paper and other supplies. See 100.3 for suggested floor area.

c. Textbooks. In schools with over 500 pupils, the storage of textbooks should be separated from the storage of instructional and administrative supplies. For estimating the central book storage needs: Determine the number of textbooks to be housed in the building; then establish a policy on the proportionate amount of central textbook storage to classroom storage. For the calculated number of textbooks to be placed in central storage, the overall square feet of bookshelving area needed can be determined by the following formula:

$$\text{Overall Square Feet of Textbook Shelving Area} = \frac{\text{Total Number of Books to be Stored}}{15^{*}}$$

---

*Library specialists figure 15 books per square feet of overall bookshelving area. (If lineal feet of book shelving is desired, librarians figure 10 books per lineal foot.)

100.27 Intercommunications System. Facilities should be provided for an intercommunications system to perform selected functions. An intercom system may be public address (sound), private telephone, or (for the future) television. An intercom system may provide for:

- Radio or recorded programs to be broadcast to one or more classrooms.
- Live performances from various points of origin to be amplified and carried through the school.
- Communication between the administration and staff and among the staff.
- Non-instructional adaptations of intercom systems to fire alarm systems, clock and scheduling systems, emergency warning signals, and school to home intercommunication for instruction of the homebound (presently in the experimental stage).
- Television transmission with talk-back as needed (future).

Note: In most schools, private telephone intercommunication between administrative unit and classroom and between classrooms has certain advantages over loudspeaker (public address) intercommunication such as: privacy, ease of initiating communication, and communication between rooms.

a. Planning a School Intercom System. The first step is to define the functions desired; then select the system which most efficiently and economically performs these functions. The following are suggestions for planning a school intercom system:

(1) The components of the intercom system should, insofar as possible, be standardized to permit flexible use and expansion when needed.

(2) The location of the console or switchboard should be determined with reference to both its administrative and education uses. It is usually located near but not in the principal's office so that it may be used by others without interruption.

b. Sound (Public Address) System

(1) Space for basic sound equipment and two or three persons at the central source would require a minimum of about 50 square feet.

(2) A four-speed record player, AM and FM radio with outside antenna, and a tape recorder should be provided at the central source. A record player and tape recorder are also desirable at other points of program origination.

(3) Microphone imputs should be provided at every planned place of program origination, such as: principal's office, central administrative office, auditorium stage, library, drama and music rooms, language laboratories, radio and television studios (if any). Some selected classrooms may be considered.

(4) Separate sound systems or added amplifying units should be considered for such large spaces as auditoriums, gymnasiums, and athletic fields. Such separate systems should be tied in with the central system so that programs originating in the special area may be carried to the rest of the school.

100.28 Planning Telephone Service. Before working drawings are prepared, the architect and superintendent should consult with the local telephone company to resolve such features as the following:

- Type of system.
- Number of trunk lines.
- Number and location of telephone stations.
- Number and location of coin box or pay telephones.
- Intercommunicating arrangements.
- Location of telephone power and switching equipment cabinets.
- Ultimate future needs anticipated.
- Cost of services.

Proper provision of conduit layout will facilitate installation of equipment required in the future due to expansion or changing conditions.

Telephone Locations. The following are some major locations which may be considered when planning outside telephone service.

- Administration unit: general offices of administrative officials.
- Guidance unit: guidance director and each counselor's office.
- Health unit: consultation or examining room.
- Audio-visual director's or coordinator's office.
- Physical education unit: instructor's office (accessible to athletic coach).
- Library: in office or workroom.

Section

School lunch: director's or dietician's office.

Music department: director's office or music library.

If office is provided:

- Business education unit.
- Distributive education unit.
- Home economics unit.
- Diversified occupations unit.
- Vocational agriculture unit.

Auditorium: in lobby adjoining for public use.

Section

Multi-purpose rooms: in lobby adjoining for public use.

Student Center: adjacent to center or school lunch dining area.

Custodial workroom or boiler room in large schools.

100.29 Data Processing Area (Optional). In large secondary schools, a room convenient to the general office for data processing may be considered if such a space is not provided in the business education unit. Early in the planning process, consult with the state supervisor of office education.

100.3 Floor Areas

TABLE 100.3. SUGGESTED FLOOR AREAS FOR ADMINISTRATIVE SPACES

SPACES		Size of School—Enrollment 500-999	1000-1499	1500-2000
Public Reception Area:	Elementary	200	250	300
	Secondary	200	250	300
General Office and Work Area:	Elementary	240	300	—
	Secondary	240	300	400
Administrator's Office				
Superintendent		150	180	200
Assistant Superintendent		150	150	150
Principal		150	150	150
Assistant Principal		150	150	150
Secretary's Office and Reception Area:	1—secretary	150	150	—
	2—secretaries	—	300	300
Record Storage, Fire Resistant:	All schools	30–55	55–75	75–100
Staff Toilets and Personal Storage:	All schools	60	90	120
Storage				
Supplies:	All schools	85	95	105
Textbooks:	All schools	#	#	#
Duplicating Area:	All schools	100	140	180
Communications Center:	All schools	50	100	100
Data Processing (optional)		—	—	400

#Librarians suggest 1 square foot of overall bookshelving area for each 15 books to be stored. The number of books to be stored centrally will be determined after considering the amount of available classroom storage.

Section

100.4 Other Detail

100.41 Heating and Ventilating. Provide for heating the administrative suite independently of the rest of the building where use of the administrative suite is contemplated during out-of-school hours. Provision for cooling the administrative suite during the summer months is desirable. Ventilate all rooms except unoccupied storage space and fire-resistant vault.

100.42 Plumbing. Drinking fountains should be conveniently located near the administrative suite in the adjacent corridor or, in large schools, in the public reception area. Soap and towel dispensers should be convenient to each lavatory in the administrative suite.

100.43 Electrical. General provisions:

a. Connections are necessary for the program schedule clock, fire alarm system, public address system, and any other electrical system provided.

b. Telephone System. See Sec. 100.28.

c. Provide at least two receptacles at convenient locations in each of the administrative personnel offices, conference rooms, public address system space, public reception area, and duplicating area or room.

An ample number of receptacles should be provided in the general office for electrically operated business machines. In offices in large schools, consider under-floor ducts with outlets as needed for electric typewriters and business machines.

d. Lighting. The general illumination in the entire administrative suite should provide the same visual comfort as in the classroom. See sec. 193.3 for suggested lighting levels.

Section

100.44 Acoustics. Administrative offices, conference rooms, and public spaces should be acoustically treated. See Sec. 171.1.

100.5 LAYOUTS. The State School Building Planning Section has developed suggested layouts for Administrative Suites including adjacent Pupil Personnel Areas (guidance and counseling, health, and other special services). These are available to school district officials and school planners upon request.

Section

100.6 CENTRAL ADMINISTRATION BUILDING. When a district has 15 or more school buildings, there are advantages in providing a central administration building furnishing space for offices of administrative and supervisory persons who have district-wide responsibilities and for specialized central services, such as procurement, initial receiving and distribution of supplies, equipment and furniture, property accounting, school plant planning, printing, data processing, and others.

SECTION 101.0 GUIDANCE FACILITIES

Section

101.1 General. Children and youth may have developmental problems as they progress through the elementary and secondary grades. As secondary pupils, they have many concerns such as educational planning, vocational choices, selecting try-out experiences, sometimes dropping out of school, meeting the adjustments of adolescents, accepting and making decisions concerning personal and family problems, and preparing to enter adult society. Qualified and well-trained counselors assist pupils in their growth and development and thus increase the effectiveness of the total educational program.

Guidance and counseling are recognized as an integral part of educational programs by educators, boards of education, parents and society in general. Basic to the implementation of this philosophy is the provision of adequate facilities for counselors and others to carry out their duties effectively.

Section

101.11 Expansion. In planning a guidance or counseling center, provisions should be made for the ultimate needed facilities based upon projected pupil enrollments and a study of local needs.

101.12 Location. The guidance unit should be easily accessible to pupils, parents and teachers and should therefore, be near a main entrance to the building, adjacent to the administrative suite (or a part of it), with a direct entrance from the corridor. The guidance unit may be near or included in a pupil personnel unit providing other related services such as health and additional psychological services.

101.2 Facilities. Guidance facilities and suggested approximate square feet of each facility for guidance units in various sizes of schools follow:

	ENROLLMENT		
FACILITY AND SPACE	Sec. Pupils 300-900	Junior H.S. 600-1200	Senior H.S. 1200-1800
	Sq. Ft.	Sq. Ft.	Sq. Ft.
Reception-Information and Secretarial Area	170	170	270
Counseling Offices	100	100	120#
Number of Offices	(3)	(4)	(6–8)
Conference-Testing Room	176	176	200**
Records Storage	80	120	160
Records Storage (district)	140	—	200
Microfilm and Microfilm Storage (optional)	—	—	40–80
Test and Supply Storage	50	80	120

#Provide one office with floor area of 150 sq. ft. for Guidance Director.

**Divisible.

Section

101.21 Reception-Information Area. This area includes a waiting space for pupils and parents, space for a secretary and clerical help (large schools), and an information area where occupational-educational materials are available for study. Except in the smallest schools, this space should be separate from the reception area of the administrative unit. It should be accessible to all parts of the counseling suite.

Suggested Equipment:

(1) Chairs should be provided for a minimum of one pupil per counselor with an additional two or three chairs for parents.

(2) Secretarial desk and chair with typewriter.

(3) Telephone, if full time clerical help is available.

(4) Transcribing equipment if counselor has dictating equipment. In some cases, one machine may be used for both dictating and transcribing.

(5) File cabinets, display racks, display board and bookshelves for storing and displaying occupational and educational information. About two-thirds of the available wall space may be used for display of occupational-educational materials. Both tackboard and pegboard are desirable.

(6) Clock.

101.22 Counseling Office. Soundproofed offices that provide privacy are essential for individual conferences with pupils, teachers, and parents because of the confidential nature of the counseling interview.

Note: A ratio of one counselor for each 300 secondary pupils should be attained with due consideration given to the availability of other pupil personnel services and the nature of the student population. In a senior high school, a ratio of one counselor to about each 250 secondary pupils is a desirable objective.

Suggested Equipment:

(1) Counselor's desk and chair.

(2) Minimum of three counselees' chairs per office.

(3) Filing cabinet with lock for confidential notes and materials.

Section

(4) A telephone should be provided for each counselor. Where full-time clerical assistance is available, an extension should be provided to avoid interruptions in the counseling interview. In large systems an intercom system permitting two-way communication between counselor and secretary is desirable.

(5) Dictating equipment. To be effective in counseling, the counselor, following the interview must keep interview notes. Dictating equipment makes it possible for him to dictate the information for his secretary to transcribe later to the cumulative records.

(6) Bookcases or shelving should be provided for the counselor's professional library.

(7) It may be desirable, in some instances, to have recording equipment available to counselors to record some interviews. Such recordings, with student approval, may be used as a basis for improving counseling.

101.23 Conference-Testing Room. A separate conference-testing room is desirable where counselor and other school personnel may meet to explore the problems or potential of an individual pupil. This room may also be used for testing small groups of pupils. It may be used by employers or college representatives in interviewing pupils. An acoustically treated folding partition will permit utilization of the room by more than one group or function.

SUGGESTED EQUIPMENT: A large table and chairs for ten to twelve persons. If divided, the testing area should have tablet arm or other appropriate seating for ten to twelve persons.

101.24 Records Storage. A pupil records area should be easily accessible to counselors and teachers. It should contain the cumulative records of the entire student body of the school and may contain those of the school district. A central storage room of file cabinets, easily accessible to the guidance department and central office will serve as the core to this area.

A work space (table and chairs with lighting level for close work) should be available adjacent to the files.

For a school of 1200 to 1800 pupils, the composite of file cabinets for the school and for the district, plus work space and room for circulation around the fully extended drawers, will require approximately 360 square feet. For the secondary school alone, about 160 square feet will be sufficient.

Section

Since the cumulative records of graduates will accumulate over the years, requiring considerable additional file cabinets and space, there is advantage in the employment of the microfilm process. For this purpose a camera device, a viewer, and a cabinet for film storage are necessary, requiring about 30 to 40 square feet of space.

Protection of all records against the hazard of fire is essential. This may be done by providing fire-resistive cabinets and microfilm storage.

101.25 Storage. This may be provided for by a storage cabinet, closet space, or by a small room. It should be in close proximity to the testing room when possible. In many cases it may be included in the same area as the pupil record room. Space should be provided for storage of secretarial supplies in addition to a variety of test materials.

101.3 OTHER DESIRABLE FEATURES

101.31 Physical Environment. The selection of furnishings, finishes, and colors should be such as to provide an informal setting and a pleasant, relaxed atmosphere.

101.32 Lighting and Ventilation. Lighting should be adequate for reading in the entire guidance unit (50 to 70 average maintained footcandles).

Counseling offices are small and the doors often closed during the day, so require adequate ventilation and provisions for cooling during the warm days of the year. Operable outside windows will assist in meeting both lighting and ventilation needs.

101.33 Acoustics. Partitions in the guidance suite should extend from floor to ceiling. Walls and doors of counselor's offices should be acoustically treated. Carpeting will assist in improving acoustics and contribute toward a pleasant environment.

101.34 Electrical Outlets. At least two duplex electrical outlets should be provided in each counselor's office, reception-information area, and conference-testing room.

101.4 LAYOUTS. Suggested floor layouts for guidance suites as a part of administrative and pupil personnel areas have been developed for secondary schools of various sizes by the School Building Planning and Guidance Sections of the State Department of Education and are available upon request.

SECTION 102.0 HEALTH CENTER

Section

102.1 Scope. The function of the Health Center is to protect and improve the health of pupils and staff, to screen or survey for health and physical deficiencies and to pursue remedial action. It may be administered by a full or part-time nurse or health coordinator, or in small schools by assignment of a staff member.

The Health Center will be used for:

- Issue of health materials (supplementary) to teachers and pupils.
- Nurse screening of teacher referrals.
- Care of pupils who become ill or those pupils who because of health conditions require periodic relief from school activities.
- Administration of First Aid.
- Vision, hearing, and other screening procedures.
- Pre-school health activities: medical and dental check-ups and immunization procedures.
- Conference on individual health problems.
- Community health activities.
- Storage of health records; first aid and health supplies and equipment.

102.2 Location. In small schools, or where a nurse is not provided, the Health Unit should be located in close relation to the administration unit which places it in good association with the school access, main entrance, and convenient supervision.

In large schools, with a nurse, director or coordinator in charge, it should be located near the guidance unit as one of the pupil personnel areas with guidance and other services, adjacent to the administrative unit.

102.3 Planning Health Service Activities

102.31 Waiting Area. Provision should be made for a waiting room with direct access from the corridor, if possible; comfortable furniture and a display area. In elementary schools, the waiting area should be equipped to suit small children's needs.

102.32 Examination Space. The examination room should provide the following:

- Privacy for examining by arrangement of the unit or by screening.
- Direct access to each rest room.
- Access to toilets, direct or through rest room.
- Access to waiting room and any offices.
- Long enough to allow 20 lineal feet in the clear for vision testing (22′ necessary).
- Sound conditioned for suppression of interference to audiometer tests.

Note: When examination rooms are used only at peak periods daily, examination space and office space may be combined, provided screening can provide privacy.

Section

Space for Equipment as follows:

- Platform scale with stadiometer.
- Table and chairs for audiometry work.
- Counter and sink with hot and cold water. The counter top should provide a large work surface, with storage below for health examination forms and other office materials; cabinets above the shelves for first aid equipment; counter electric outlets for appliances and machines.
- Cot or couch; three-section folding screen.
- Examining table; sterilizer; movable spotlight.
- Waste basket and foot operated disposal can.
- Cup and towel dispenser.
- Full length mirror.

102.33 Office Area. The nurse's office area should be distinct from the examining area but not entirely separate. Provision should be made so that parent and pupil conferences may be made in privacy. This space should be equipped with desk and chair, filing cabinets, two straight chairs, typewriter and stand, personal clothes closet, and outside telephone line. A portion of the examining room affording privacy by means of a folding partition may suffice as an office area in some schools. This area should be equipped as described above.

102.34 Rest Rooms. Several rest spaces, isolated from each other and distinct from other spaces, should each contain a standard size cot (about 6′-10″ x 3′-3″). Toilet rooms should be immediately adjacent to the rest area. If a rest room is provided for each sex (necessary in secondary schools), each should have access to a toilet adjoining. Rest rooms should be light and quiet with enough space for the cots, bedstand, wastebasket and circulation.

102.35 Storage. A ventilated walk-in closet for storage of linen, pillows, blankets, folding litters, crutches and other essential supplies should be provided. The closet should open into the examining room. Some schools prefer smaller closets, about 8 square feet with adjustable shelving 18″ deep opening off each rest room.

102.36 Isolation Room. If an isolation room is provided, it should open into the examining room and contain space for one cot.

102.37 Offices for Physicians, Additional Nurses. If provided, these offices should be on a passage connecting them to the waiting room, examining room and corridor. A floor space of approximately 80 square feet would be adequate for each office.

102.38 Dental Clinic. When a dental clinic is desired, space for it should open off the examining room or a passage connecting it. Space should be provided for a dental chair with connections for gas, water, electricity and drainage. Space will also be needed for a lavatory, work table, files, and instrument cabinet. A floor area of about 100 square feet is required.

102.4 FACILITIES—RECOMMENDED FLOOR AREAS

TABLE 102.41. SUGGESTED SIZES OF HEALTH SERVICE FACILITIES FOR SCHOOLS OF VARIOUS SIZES (in square feet)

ENROLLMENT	200-450	450-1000	1000-1500	1500-2000
Waiting Room	80	100	140	170
Examining Room	100	100	100	100
Storage	25	30	45	60
*Office Area	60	80	80	100
**Rest Spaces (Total area for boys and girls)	120	200	280	320
Cots: Boys	(1)	(2)	(3)	(3)
Girls	(2)	(3)	(4)	(5)
#Toilets	50	50	100	100
TOTAL AREA	435	560	745	850

*In small schools may be an area in examing room. In schools with 450 or more pupils, separate the office area (for privacy) by a folding partition.

**Estimate each cot space provided at about 40 sq. ft. per cot. The suggested number of cots must be qualified by local conditions.

#About 50 square feet provides one toilet for boys and one for girls. In larger schools there will be need for more toilet space.

Section

102.42 Additional Optional Spaces

Office space (Additional professional personnel)	80 sq. ft. each office.
Dental clinic	100 sq. ft. all schools.

102.5 VENTILATION. All rooms in the health center should be ventilated. The exhaust air from the isolation and rest rooms should not pass through other rooms of the health service suite and no air from the health service suite should be recirculated or exhausted into the corridor or other pupil-occupied spaces.

Section

102.6 PLUMBING. Hot and cold water should be provided at all lavatories in this unit.

102.7 ELECTRICAL. At least one receptacle should be provided in each room of the Health Service Unit. Additional outlets are needed in the examination room for audiometer, eye chart, sterilizer, clock and other appliances. The receptacle for illuminating the vision chart should be placed on the wall opposite from any window. The light provided in the rest rooms should be subdued to 10 footcandles to encourage rest. The light in the other areas should be the same as in classrooms. See Sec. 193.3.

SECTION 103.0 TEACHERS ROOMS

Section

103.1 Scope. Faculty members should be provided space to pursue professional work, conferences with others, and facilities for comfort and relaxation. Facilities to serve the faculty include: (1) teachers workrooms, (2) teachers rest rooms or lounge, and (3) faculty toilets.

103.2 Teachers Workroom

a. A teachers workroom should be provided in schools with 15 or more teachers, located near the administrative suite. It may be located as an area or room in the Instructional Materials Center. See Sections 72–73.

b. Features:

(1) Should accommodate at desks or tables 15 to 20 percent of the number of teachers. Some individual study carrels should be provided.

Note: Large secondary schools may provide departmental office centers with individual office areas (about 50 sq. ft.) for each teacher.

(2) Should be comfortably and informally furnished with provision for individual desks or tables, tackboard, chalkboard for demonstrations, a large study table, and one or two typewriters and typewriter tables.

c. Where teachers combine efforts, as in cooperative or team teaching procedures, separate study or preparation centers, including resource materials storage, are necessary.

d. In schools where a conference room is not provided in administrative suite the teachers workroom may be located and arranged to serve as a conference room.

103.3 Teachers Rest Room or Lounge. This space is desirable and generally provided.

a. Features: Some schools of 20 to 30 teachers provide a single large lounge with adjoining toilets for each sex.

Some large schools provide a workroom to be used jointly by men and women teachers, with a lounge and connecting toilet for women on one side and similar provisions for men on the other side.

Some schools are locating a teachers lounge and toilets adjoining the teachers' dining area in the foods center. The lounge may be separated from the dining area by a folding partition which when open provides a multi-use area.

b. Furnishings. Women's lounge rooms are usually furnished with comfortable chairs, sofa, powder table, mirror, and adjoining toilet. Men's lounge rooms are similarly appropriately furnished. Lockers or a clothes closet may be provided for hanging garments of substitute teachers, field supervisors, and visitors. In some schools, a kitchen alcove with hot plate or snack bar unit may be desirable.

103.4 Faculty Toilets. Faculty toilets for each sex are essential in every school.

a. Features:

(1) They should be located adjoining the teachers workroom or lounge, or alone.

Section

(2) They should be adequate in size to accommodate an ample number of fixtures. Fixtures are suggested as follows:

One lavatory for each 10 women (women's toilet) and each 10 men (men's toilet).
One urinal for each 20 men.
One water closet for each ten men.
One water closet for each 7 women.

b. Water closets and urinals should be vestibuled and lavatories located so that they are available when water closets are in use.

c. In large multi-storied buildings, faculty toilets should be provided on each floor and in a campus type arrangement of units, in each building.

103.5 Other Detail

103.51 Display. At least 12 square feet of tackboard, 36″ to 42″ high, should be provided in each teacher's workroom and lounge. Facilities for hanging pictures are desirable in the workroom and lounge. Some chalkboard for demonstrations is desirable in the workroom.

103.52 Bookcase. An open front bookcase, or a bookcase with glazed doors, with at least 10 lineal feet of adjustable shelving 10″ deep should be provided in the teachers workroom and lounge.

103.53 Electrical. At least two receptacles should be provided in each teachers workroom and lounge. Receptacles or outlets should be provided for clock, public address system, radio or television.

General lighting in workrooms should be the same as for classrooms, but subdued to 10 to 15 foot candles in the lounge.

103.54 Audio-visual. Structural provision should be made for darkening the teachers workroom for use of audio-visual aids.

103.55 Acoustics. Acoustical treatment of teachers workroom and lounge is desirable.

103.56 Heating and Ventilation. See Sec. 241.1 for recommended air changes and exhaust.

103.57 Plumbing. Water closets, lavatories, and fittings should be selected and installed to suit adult needs. Hot and cold water service to lavatories is recommended. Provide soap and towel dispensers at lavatories and toilet paper dispensers at water closets.

Provision for drinking water in the teacher's workroom or lounge is desirable. An electric cooler or standard drinking fountain set 42″ from floor to nozzle is suggested.

103.6 Smoking Rooms in Schools. There is reason to question the advisability of providing space for faculty smoking in school buildings since pupils tend to follow the examples set by teachers.

It is a fact that clothing carries the smell of tobacco smoke and that non-smokers leaving a smoking room smell the same as smokers. Therefore, if smoking is to be permitted in lounges or teachers' rooms, separate space for smokers and non-smokers should be provided since pupils should not be led to believe that all teachers are smokers.

SECTION 104.0 STUDENT ACTIVITY ROOMS AND CENTERS

104.1 Student Activity Rooms

104.11 Scope. Student activity rooms in secondary schools provide appropriate space for a program of general student activities under the direction of the school. These activities are varied. They may include student councils, school publications (except production), student clubs, and committees. The room may also be scheduled for the use of small study or research groups.

104.12 Number of Rooms. At least one student activity room should be provided in each school. A conference room equipped for multi-use as a student activity room may serve the same purpose.

104.13 Location. The student activity room may be located convenient to the business education department where typewriters and adding machines are available. Additional activity rooms should be convenient to the appropriate areas to which activities are related.

104.14 Size. For general activities, a room of 220 to 300 square feet should be provided. Where permanent special activities are planned, the room may be sized and equipped for the activity but flexibility should be maintained.

104.15 Equipment. A general student activity room should be equipped with:

- Work counter with storage compartments that can be assigned to groups permanently and individually locked. A work sink may be desirable.
- Other storage as needed.
- Some chalkboard, tackboard, and display facilities.
- Room darkening facilities for use with audio-visual aids.
- Electrical receptacles adequate for activities scheduled.
- May include outlet connecting with public address system.

104.16 Other Detail. Heating, ventilation, lighting, acoustics the same as required for a general classroom. Finish to provide an informal and comfortable atmosphere.

104.2 Student Activity Center. Some school planners believe the physical spaces to house student activities and services should be incorporated in a "Student Activity Center."

In such a plan, a student activity room (about 200–300 square feet) will be located in the STUDENT CENTER area. Activities will include student council meetings, student record keeping, and other student body business. The student activity room will have direct access to the student dining area.

The STUDENT DINING AREA will be utilized for formal and informal social activities. It will also be accessible from the gymnasium, for use after athletic events, be equipped with some folding partitions to facilitate use by small groups, and it may have a small portable stage located at one end for informal programs.

104.3 Combination Adult Education and Student Activity Rooms

104.31 Scope. A combination adult education and student activity room may fit into many communities. This combination room may serve parent and other adult educational activities, especially in the afternoon and evening. It may be used most of the school day by pupil's organizations of all kinds organized under the school's direction.

104.32 Space. An area of about 1200 square feet will provide space for classroom and other activities.

104.33 Location. The combination room should have direct access to the outside, be near the main entrance, and be able to be used separately from the rest of the building.

104.34 Equipment. Desirable equipment includes: a coat hanging space, adult folding chairs, tables, sink, cupboards, large display area, one wall of chalkboard (about 16′), and a small portable platform about 6″ high.

104.35 Storage. Provide:

- Storage space for folding chairs and tables.
- Storage cabinets with lockable compartments for perpanent assignment to groups, along the inner wall or at some appropriate location.
- Filing cabinet(s) as needed.

SECTION 105.0 THE SCHOOL LUNCH UNIT

Section

105.1 General. This section describes facilities that will serve for a variety of school lunch services and will serve particularly to facilitate participation in the National School Lunch Program. The prevailing type of food service is the Type "A" plate lunch. Counter service is the general procedure. Whether a complete Type "A" lunch is served or variety is added to the program, the facilities will not be affected greatly.

For planning and equipping details beyond the scope of this section, see "A Guide for Planning and Equipping School Lunch Rooms," P.A. 292. U. S. Department of Agriculture, Agriculture Marketing Service (Government Printing Office, Washington, D.C.).

105.11 Basic Food Service Principles

a. Center. All eating at lunch time, whether purchased lunch or brought, should be in the dining areas provided and facilities should be adequate for the purpose.

b. Time. Lunch should be eaten by everyone in the middle of the day, within 1½ hours.

c. Dining Areas and Seatings. The dining area should be based on not more than three 30 minute seatings or shifts. In schools with less than 300 pupils two shifts are sufficient.

d. Educational Program. A continuous program of education should be planned to encourage desirable eating habits and the dining facilities should exemplify this program.

e. Participation. Allow ample space for a high percentage of school lunch participation by the ultimate student body. If the lunchroom is to be used for adult group meetings and other school community services, allow space for accessory items that may be needed.

f. Economy. To get maximum results for the money expended, plan the school lunchroom for use without major remodeling for many years.

g. Health. Facilities should be adequate to serve a high quality lunch. They should be utilized and maintained to protect the health of those dining.

h. Sanitation. Equipment must include sanitizing devices for washing and sterilizing dinnerware and utensils. Sanitary facilities for storing dry foods and perishable products are essential.

i. Environment. Consider cleanliness, good lighting, cheerful colors, good ventilation, and noise control.

105.2 Location

a. Kitchens. Kitchens for food preparation on the school site should be located convenient to a short, direct service drive to the loading platform, away from school traffic or main entrance.

b. Dining Rooms. These should be located to provide:

(1) Easy access to pupils on grade level or main entrance level.

Section

(2) Safe, direct pupil traffic lanes that leave the dining area near the dishwash room.

(3) Convenient access to the public for evening and vacation use without the necessity of opening the entire school building.

(4) Proximity to the gymnasium and auditorium.

105.3 Facilities: General

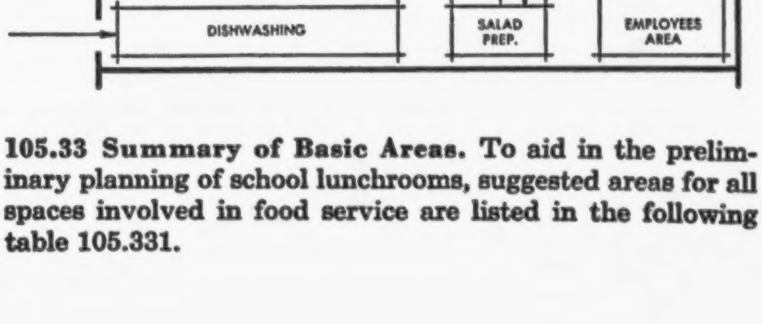
105.31 Basic Areas. Facilities to house and carry out the school plan are as follows:

(1) Receiving area
  (a) Outside
  (b) Inside
(2) Food storage area
(3) Nonfood storage area
(4) Food preparation (kitchen) area
(5) Serving area
(6) Dining area
(7) Dishwashing area
(8) Maintenance area
(9) Office or planning area
(10) Employee's locker and toilet area.

105.32 General Arrangement. Kitchen facilities should be planned to permit the moving of food materials from the loading platform to the inside checking area, through storage to the preparation areas and then to the serving areas in direct routes. They should provide for the maintenance of sanitary conditions in the kitchen, the comfort of the employees, and the business details of ordering, purchasing, and checking.

Kitchens should have direct access to receiving areas, garbage and trash rooms, mop closet, food storage—dry and refrigerated, and serving area, and should have easy access to nonfood storage, dishwash room, dining room, and employees' locker room. The following flow chart illustrates the relationship of the different areas:

105.321 Flow Chart: School Lunch Operations



105.33 Summary of Basic Areas. To aid in the preliminary planning of school lunchrooms, suggested areas for all spaces involved in food service are listed in the following table 105.331.

105.331 TABLE: SUMMARY OF APPROXIMATE SPACE ALLOTMENTS FOR BASIC AREAS IN SCHOOL LUNCHROOM UNITS IN TERMS OF TOTAL LUNCHES SERVED DAILY (Prelim. planning)

Meals Served Daily	300	600	1000	1500	2000
AREA DESIGNATION	Approx. Sq. Ft.	Approx. Sq. Ft.	Approx. Sq. Ft.	Approx. Sq. Ft.	Approx. Sq. Ft.
Receiving area:					
Loading platform	60	100	140	160	200
Inside receiving area	60	75	100	130	160
Dry food storage area	225	390	500	750	1000
Nonfood storage area	48	60	80	100	120
Kitchen area (food preparation and refrig. storage)	750	850	1200	1500	1800
Serving area	300	500	700	900	1000
Dishwashing area	180	180	285	315	400
Maintenance area:					
Garbage area	60	60	80	90	100
Trash area	30	30	40	50	60
Mop area	30	30	40	50	60
Office area	60	60	72	84	96
Employees locker and toilet area	60	60	76	96	120
TOTAL: Kitchen and Service Area	1863	2395	3313	4225	5116
Dining area: (2) or (3) seatings as indicated	1800(2)	3600(2)	6000(2)	6000(3)	8400(3)
Faculty dining area	280	280	480	720	1060
GROSS LUNCHROOM UNIT AREA	3943	6275	9793	10945	14576
AREA PER MEAL SERVED	13.1	10.4	9.8	7.3	7.3

NOTE: There will be considerable variation in design and space allotment in school lunch units serving more than 1000 meals daily, i.e., specialized kitchen equipment and storage, number of shifts and serving counters, etc.

Section

105.4 FACILITIES: SPECIAL AREA CONSIDERATIONS

105.41 Receiving Area

a. OUTSIDE LOADING PLATFORM. This should be located on a service drive away from playgrounds and pupil traffic. The floor should be at the height of a truck floor for loading and unloading. It should provide completely covered circulation from loading point to service entrance, storage, garbage room or trash room entrances, with no steps to hamper wheeled equipment. Floor should be hardened concrete with bumper edge for truck stop, sloped to drain, with no rail except for steps to ground level. Roof should be higher than truck roof, approximately 12′-6″ above driveway. Septic tanks and gas installations should be elsewhere. See 105.331 for space suggestions.

b. INSIDE RECEIVING AREA. The receiving or checking area should be located inside, preferably separate from the kitchen and storeroom, and may serve as a vestibule. Provide heavy duty doors between the loading platform and receiving area inside; door openings at least 40″, self-closing and locking devices, kick plate on each side of the door.

(1) Required space will vary depending upon frequency and volume of deliveries and time required for checking. See 105.331.

(2) Finish. Same as kitchen.

Section

(3) Equipment. A built-in standup desk or shelf approximately 12 inches by 18 inches by 42 inches high is ideal.

Automatic indicating or beam-type scales are needed for weighing in foods. Portable floor model type scales are desirable, with a minimum of 400 pounds capacity and ¼ to ½ pound graduations.

105.42 Storage Areas

105.421 Dry Foods Storage. Subject to local conditions, should be planned for a two weeks supply of purchased foods and a six weeks supply of donated government commodities.

a. LOCATION. Directly accessible from the food preparation area, convenient to receiving area and manager's office.

b. SPACE. Allow ¾ to 1 square foot of floor area per meal served, depending upon quantities of food bought at one time and quantities of USDA donated foods requested.

c. FINISH. Same as kitchen, but painted masonry or plastered walls and hardened concrete floor are acceptable; vermin and rodent proof; subfloors vapor sealed below ground; coved bases at floor line. Check local codes for required floor drains.

d. DOORS. Should be at least 40″ wide; heavy duty; with outside lock, but always openable from the inside without a key.

e. TEMPERATURE. Dry food storage must be kept cool: 50° to 70° F. (40° to 45° F. desirable for many foods); keep area free from heat producing devices such as uninsulated pipes, water heaters, condensing units.

f. THERMOMETER. A reliable wall thermometer is essential. Mount the thermometer in the vicinity of the door, about eye level. It should not be mounted on the door, near a light bulb, or in a recessed pocket.

g. VENTILATION. Positive storeroom ventilation is necessary. Four to five air changes per hour are adequate. Mechanical or forced-air ventilation, with intake and/or exhaust fans, is desirable.

NOTE: If food is stored through the summer months, provide separate ventilation.

h. SHELVING. Experience indicates that not more than 25 or 30 percent of the storage space should be provided shelving, leaving ample free space for portable storage racks, skids, and dollies recommended for storing cases, bags, drums, etc., for mobility and better air circulation.

Shelving should be substantial, wood or metal, adjustable, well braced against tipping. Upright supports should be not more than 48 inches apart. The maximum practical height is 7 feet 6 inches. Allow 2 inches clearance from all walls for cleaning and air circulation. The bottom shelf may be 24 to 30 inches deep; other shelves 18 to 20 inches deep. Floor to first shelf should not be less than 11 inches; and not less than 3 feet 3 inches when storage of metal containers on dollies and sacked and cased foods on portable platforms under first shelf is desired.

i. STOREROOM EQUIPMENT. Portable equipment is needed for the efficient handling and storage of food. In addition to the two-wheel and four-wheel handtrucks used in the receiving area, it is desirable to provide shelf-type trucks, skids, and dollies.

Pallets or semilive skids may be used for storing sacked foods, cartons, etc. Semilive skids become portable with the use of a lift jack.

Dollies are platform and open-frame, of heavy gauge steel or wood, with caster mountings. A can dolly is needed for each food storage container unless the containers are equipped with casters.

Metal containers with casters are available in 50 or 100 pound sizes. Such containers with tight fitting covers should be used for storing broken lots of such items as flour, cornmeal, sugar, dried beans, rice and similar foods.

Power or hand-operated fire extinguishers should be available in the storeroom or nearby in the kitchen.

105.422 Nonfood Storage. This space provides storage for kitchen and dishwash cleaning supplies, paper goods, insecticides, and similar supplies. It should be separate from mop closet and good storage and adjacent to receiving area. For suggested size, see 105.331.

a. FINISH. Same as dry food storage.

b. SHELVING. Begin shelving 36 inches off the floor and size for carton goods; about ½ sq. ft. of shelving per meal served for small schools to ¼ sq. ft. for large schools. Provide some free floor space for bulk supplies on skids or dollies.

105.43 Maintenance Area. Locate near service entrance. Garbage and trash areas should open onto loading dock; mop closet to receiving area.

105.431 Garbage Area.

NOTE: Reduce or omit space if food disposers and incinerator available.

An outdoor screened or enclosed platform for temporary storage of garbage is desirable. There should also be an area, separate from trash storage, due to wet conditions, providing space for cleaning, scalding, and storage of empty cans. For size of garbage area, see 105.331.

a. CAN WASH. About 6 square feet is needed for washing garbage cans. This portion, approximately 2½′ x 2½′, should be depressed to prevent refuse from washing over the entire area and should be fitted with a 3″ minimum floor drain and hot and cold water outlets. The water controls should be high enough to clear the cans (about 3′ 6″) and removable if in an unlocked area.

b. FINISH. Floor of quarry tile or concrete with hardener.

c. DOOR. Heavy duty 36 inch, with guard and kick plate on both sides.

105.432 Trash Storage Area. This is a room or enclosure for the temporary storage of trash and discarded containers. For suggested size see 105.331. Reduce space if incinerator is used. Provide a clear floor area with slatted shelf 18″ wide not less than 5′ from the floor.

105.433 Mop Closet. The mop closet should open into the receiving area and contain a hanging rack for mops and brooms, with shelves for cleaning materials for floors and garbage cans. Provide a service sink and floor drain or a receptor providing this drain. Good ventilation is essential to prevent odors from wet mops.

105.44 Kitchen Area

105.441 General:

a. LOCATION. Should be adjacent to receiving, dining and serving areas; easily accessible to food storage area.

b. SIZE. The kitchen size is based on the space for equipment and operations needed to prepare a certain number of meals. Because of the cost of necessary utility installations, kitchen and auxiliary space should be planned and built for the maximum meal load anticipated, even though some equipment may be omitted until needed. Rearrangement and expansion are expensive. The following may be used as a general guide for the preliminary allotment of space.

Daily Meal Load	Approximate Area Per Meal Served	Approximate Kitchen Area
300–600	2.0–1.4 sq. ft.	600– 850 sq. ft.
600–1000	1.4–1.2 sq. ft.	850–1200 sq. ft.
1000–2000	1.2–0.9 sq. ft.	1200–1800 sq. ft.

Section

c. **Shape.** A rectangular kitchen of good proportions and with the serving counter on the long axis is usually the best arrangement.

d. **Sequence.** Food proceeds generally from receiving area to storage, to preliminary preparation, to preparation, to serving. Some foods proceed directly from storage to preparation, others may involve a minimum of preparation and go almost directly to serving.

105.442 Refrigerated and Frozen Food Storage. Estimates of storage requirements based on Minnesota experience are as follows:

Reach-in and walk-in	about ¾ cu. ft. per meal served daily (average participation)
Frozen food	about ¾ cu. ft. per meal served daily.

a. **Reach-in Refrigerators** should be supplied as needed in 20, 40, or 60 cu. ft. capacity. When total capacity exceeds 60 cu. ft. consider both reach-in and walk-in storage. Reach-in refrigerators should be institutional type, interior and exterior finishes non-corrodible and easily cleaned. Interiors should be fitted with door operated electric lights, adjustable plated wire shelves or noncorrodible slides for trays. A pass-through unit that opens from both sides may be advantageous. The reach-in refrigerator in which salads are stored should be located near the serving counter and the salad preparation counter. The second refrigerator which may be the walk-in type should be located near the delivery entrance and convenient for the cook's use. All refrigerators should have locking hardware.

b. **Walk-in Refrigerators (Coolers)** may be commercial or built-in. The walk-in should be flush with the floor so that carts and racks can be wheeled directly into the unit and the box may be easily cleaned. A drain should be located just outside the door. Walk-ins that are at least 8′ by 10′ should be considered to allow two storage areas 30 to 36 inches wide with a 3 to 3½ foot aisle. Doors should be wide enough (minimum 42″) to permit passage of mobile equipment.

c. **Freezer Storage.** As frozen foods are being used more and more, consideration should be given to storage space for these foods. Frozen food storage space depends on purchasing practices, frequency of delivery, and number of meals served. One cu. ft. will store 30 to 35 pounds packed in cases. **Walk-in Freezers.** Walk-ins at least 8′ x 10′ are recommended.

d. **Milk Refrigeration.** Allow 1 cu. ft. for each 50 half-pint cartons. The milk station should be at or near the counter. Milk may be distributed from a cooler or from cases carted from the walk-in cooler. Dispensers are also used.

SUGGESTED REFRIGERATED AND FROZEN FOOD STORAGE

Ultimate Daily Meal Load#	Total Cu. Ft. Recomm.*	Reach-In Cu. Ft.	Walk-Ins** Cooler (Cu. F.)	Walk-Ins** Freezer (Cu. Ft.)	Walk-Ins** Cooler (Sq. Ft.)	Walk-Ins** Freezer (Sq. Ft.)
300	*	20	*	*	(min.) 80	80
500	*	40	*	*	(min.) 80	80
750	1125	60	532	532	(min.) 80	80
1000	1500	60	720	720	96	96
1500	2250	60	1095	1095	144	144
2000	3000	60	1470	1470	196	196

#Average daily participation based on projected ultimate daily meal load.

*In general, about 1½ cu. ft. of TOTAL refrigerated and frozen food storage for efficient use of federal surplus foods and modern school lunch program. Since "minimums" apply to meal loads of 300 and 500 meals, cu. ft. for these loads is not given, except for reach-in. Minimum walk-in should be 8′ x 10′ or 80 sq. ft.

**In the examples for various sizes of daily meal loads, the cubic feet or sq. ft. recommended for walk-ins is equally divided between coolers and freezers. This ratio of cooler to freezer space may be adjusted to suit local needs.

Note: In estimating sq. ft. of walk-ins from cu. ft., a clear inside height of 7′-6″ was used. Quotients were adjusted to even walk-in sizes.

Section

105.443 Kitchen: Food preparation and Equipment Placement

a. **Food Preparation Area.** This space will include: (1) Hot Food Preparation Area, (2) Salads and Cold Foods, and (3) Baking. For a list of suggested cooking, baking, and mechanical equipment see Section 105.53 and Appendix—School Lunch 105.6.

b. **Equipment Placement.** Kitchen equipment should be arranged in logical order, by work area. Groupings within a work area may combine or overlap, depending on the size of the kitchen unit. In general, place:

(1) Range and cook's table convenient to pot sink, refrigerator and serving counter where hot foods are served.

(2) Oven and baker's table convenient to each other and to pot sink, refrigerator and serving counter.

(3) Vegetable sinks near point of delivery, refrigerator and serving counter.

(4) Where one mixer is provided, mixer convenient to

both baker and cook mounted on a portable stand equipped with lock casters.

(5) Refrigeration close to delivery entrance, vegetable and salad preparation, cook's table, baker's table and serving counter.

(6) Work tables located for convenience in relation to preparation equipment: ranges, ovens, steam equipment and mixers.

(7) Right to left direction is usually more convenient than left to right, i. e., vegetable peeler at right end of vegetable sink; soaking sink at right end of pot sink.

(8) "Island" installation of cooking equipment facilitates cleaning and makes it accessible from all sides.

(9) Any equipment which is not readily movable should be installed a sufficient distance from other fixed equipment or wall to allow a space for cleaning. The exact distance will depend on the size and type of unit. See item c. below.

(10) In selecting equipment, consideration should be given to modular coordination. For example, baker's cooling racks, refrigerators equipped with angle ledges instead of shelves, under counter and other storage units are available for use with standard pans.

c. Aisle Allowances. Optimum aisle allowances are as follows:

(1) Between oven equipment and work tables	3¼ feet
(2) Traffic aisles	3½–4 feet
(3) Traffic aisles where portable equipment used	4 feet
(4) Between front of refrigerator and other equipment	3½ feet
(5) Between two work tables	3½–4 feet

d. Spacing for Cleaning. Cooking equipment should have 18″ clearance for cleaning, tall equipment 12″, sink and table rims and adjacent units 6″.

e. Steam Equipment. Every effort should be made to provide steam equipment as needed. Steam jacketed kettles and steamers with self-contained gas or electric steam generators and in combination units are available. Floor area under steam equipment may be:

(1) Depressed 2 or 3 inches.

(2) Surrounded by a low curb.

(3) Provided with a gutter with flush grating. (There may be a hole in the grating of the floor drain so that a large stainless steel funnel may be used to avoid splattering while draining.)

f. Portable Equipment. All types of receiving, preparation, holding, and serving equipment are being put on wheels: scales, carts, utensil racks, storage bins, shelving, chopping and slicing machines, cooling racks, proofing cabinets, mixers, serving counter units, pot and pan soaking sinks, vegetable peelers, small work tables. Portable kitchen machines should have retractable legs or a locking device

g. Vertical Storage. Vertical storage in the kitchen is a means of keeping the kitchen compact. The application is in panracks, cooling racks and utensil racks. As many as 20 sheet pans of baked goods can be housed vertically in a floor space less than 2′ x 3′. Racks for utensils, supplies or finished products may also be used over other pieces of equipment such as steamers, mixers, work tables.

h. Use of Partially Prepared Foods. Certain adaptations need to be made in kitchen planning when market conditions and labor costs warrant the use of convenience foods.

(1) If ready-to-cook vegetables (canned, frozen, dehydrated, fresh prepared) are used, there is little use for a vegetable peeler and sinks.

(2) Reliance on frozen foods requires more food storage.

(3) Ready-to-cook meat, poultry, and fish may make handling equipment unnecessary.

i. Cooking Fuel. The selection of fuel depends on local utility rates and services as well as original cost of equipment and upkeep.

105.444 Kitchen. Finishes

a. Floor. Should be impervious and slip-resistant with coved base. Resilient floor: slip resistant vinyl-asbestos or greaseproof tile or rubber tile. Non-resilient type (these are more durable): quarry or ceramic tile, or terrazzo. Provide fireproof solid base or islands under ranges and ovens; curbs or gutters around steamers, kettles, and vegetable peelers, with separate floor drains. Locate other drains out of work area.

b. Walls. Smooth, nonabsorbent, easily cleaned and light colored. Glazed ceramic or structural tile preferred. Hard plaster acceptable.

c. Ceiling. Exposed construction should not be used. Acoustical finish should be non-absorbent, rodent proof, fire resistant and cleanable. Plaster should be waterproof and mildew resistant.

d. Doors. If outside doors, use self-closing devices and locks. Inside doors should be soundproofed with wire glass lookouts and locks.

e. Windows. Locate for good ventilation, with sills at least 48″ high to permit equipment under, and sloped about 45°.

105.445 Kitchen: Other Construction Features

a. Ventilation. All kitchens should be mechanically ventilated to provide at least 20 air changes per hour. Supply air may be drawn from dining room or outside. Supply fans should provide uniform distribution of air in the kitchen; be supplied with screens and automatic shutters; be individually switched for controlling ventilation rate. Cooking equipment (steamers, steam jacketed kettles, ranges, gas ovens) should be supplied with special ventilation.

Under Shelf Ventilator projects forward from the rear edge of the cooking equipment. This type of installation catches the heated air and steam closer to the point of origin and draws it through a filter or baffle system. The under shelf ventilator is normally the same length as the cooking equipment.

Overhead Canopy or Hood overhangs the cooking area on all sides. It should have an inlet capacity of 100 CFM per square foot at the bottom edge of the hood. If blankoff sheets are incorporated, the inlet capacity of the free area should be based on 125 CFM per square foot. The hood is usually equipped with removable, washable filters and vapor-proof lights. Exhaust fans should be furnished with sealed bearings and mounted so as to minimize vibration.

Section

b. PLUMBING. Whenever possible, piping should come out of wall instead of floor, with at least an 8″ clearance for cleaning floor. Drainage and waste lines should have accessible clean-outs. Drainage for steamers, steam-jacketed kettles, pot sinks, prewash and diswasher may need to be through a grease trap inside or out. The need for grease traps should be determined before installing. Disposal units should bypass the grease trap. Provide refrigerator and other special connections according to state and local plumbing codes. Floor drains should be located away from traffic and work aisles. One-quarter inch to 10 feet is suggested as the proper pitch to floor drains. When the pitch is greater than this, it is difficult to level equipment.

Handwashing facilities for foodhandlers are required. Locate in food preparation area. Hand lavatory: vitreous china or porcelain enamel on cast iron; standard size; mixing faucet. Provide soap and paper towel dispensers.

c. LIGHTING. Both natural and artificial lighting are desirable. Windows are preferable to skylights. Skylights if used should be light diffused. Thirty foot candles are needed on all work surfaces.

d. ELECTRICAL. The lighting circuit control panel for all school lunch areas and power circuit control for kitchen should be readily accessible in the kitchen. Voltage requirements for equipment should be determined and wiring and outlets provided accordingly. Spare circuits for future needs are necessary. Switches should be within the reach of workers. Protect wiring against heat and grease. Locate one grounded duplex outlet (120 volt single phase) 6 inches above working level approximately every 10 feet, each to be on a 20 ampere fuse or circuit breaker, using No. 12 conductor. Do not depend on these duplex outlets for heavy equipment. If island working areas are planned, have electrical outlets out of floor 8 or 10 inches high by work tables for use with mobile equipment.

e. BULLETIN BOARD. A small 2′ x 4′ bulletin board is essential in the kitchen for posting menus, health cards, work schedules and other notices.

105.45 Serving Area

105.451 General. The serving area should be equipped to serve a line of pupils in selecting their lunch and paying for it in an orderly manner. It should protect the food from contamination and keep it appetizing.

a. LOCATION. The serving counters should be located to provide direct access from the dining area, and to route traffic without confusion to the dish return counters.

b. SEPARATION. In order that the dining room area may be used for other purposes, the serving area should be separated from the dining room by a full height, sound-proofed partition with lockable doors for entrance and exit. For increased ventilation and visual supervision, operable sash may be used.

c. SPACE. Serving area, if separated from the dining and kitchen area, will require 10–12 square feet of floor area for every foot of counter length. Provide the same general features of construction as kitchen area. See Sec. 105.331 for space suggestions.

Section

d. FINISH. Walls adjacent to serving counter and student traffic should be washable, preferably tile.

105.452 Serving Counters

a. SIZE. Length will vary with type of meal offered and number of meals served. Counters vary in length from 16 feet, including refrigerated milk service, to 25 or more feet. Dish storage is provided under counter or portable dish trucks may be used under counter in place of fixed shelving.

Width is 28″ to 30″; 28″ preferable for elementary schools. An additional width of 12″, rnning the entire length of the counter is needed for a tray slide.

Height. Counter working height is 34″ to 36″. Tray rail height: elementary—30″ to 32″; secondary—34″ to 36″.

b. NUMBER OF COUNTERS. Depends on (1) the total meals to be served, (2) the seating capacity of the dining room, (3) the required seatings or shifts (item (1) divided by item (2)), the number of pupils who can be served per minute per counter (about 10 pupils per minute). In general, one counter is needed for every 200–250 dining room seats. One counter would serve 200–250 pupils in 20 to 25 minutes.

c. ORDER OF COUNTER UNITS. Serving counters are now available in modular units which may be assembled in any order. Some of these are portable for increased flexibility and to facilitate cleaning. Depending upon local preference, the order may be:

Cashier's Section	2 ft.
Trays and Silver	3 ft. to 5 ft.
Hot Items	3 ft. to 5 ft.
Cold Items	5 ft. to 6 ft.
Milk Chest	4 ft. to 6 ft.

CASHIER'S SECTION. The end of the counter may be recessed for knee space. If the cashier is at the exit end of the serving counter, the tray rail needs to extend to the cashier. If electric equipment is used, electric receptacles should be provided.

TRAY UNIT. The tray unit should be portable to permit loading in the dishwashing area and rolled into position at the serving counter. Such units are available with silver containers attached. The tray section, 12″ x 18″ for 12″ x 16″ trays) should be above the floor so that the stack of trays is not beyond reach.

SILVER. May be included in the tray unit; sometimes round cut-outs in the serving counter are provided (3⅞″ diameter), only the handles exposed.

HOT FOOD SECTION. For main dishes and vegetables. Standard 12″ x 20″ pans are usually used for serving. Cutouts to receive these may be provided or the hot portion of the counter dropped 8″ to facilitate serving from stock pots or 12″ x 20″ steam table pans or heavy bake pans. Heated food tables are not essential. Hot food, freshly prepared, is served before it has time to cool.

NOTE: Portable hot food units holding one 12″ x 20″ pan are available.

COLD FOOD SECTION. This is usually a flat section of counter for salads, relishes, bread, butter and desserts. Refrigerated pans and display shelves are seldom used.

Milk Station. A refrigerated self-service milk chest may be used in the serving line for individual 8 oz. containers. Some milk boxes are self-elevating to keep the containers at the top of the cooler. Some schools use stainless steel carts for milk kept cool in a walk-in refrigerator. Automatic dispensers are used for bulk milk in 3, 5, or 10 gallon containers, capacity one to three cans; self-contained mechanical cooling equipment; automatic measuring device preferred. Local use with "special milk" program will determine arrangement.

Note: If individual milk bottles are used, store milk in cases and let pupil take from case as he passes through line. Avoid handling of individual bottles.

Tray Rail. Tray rails are regarded as optional. The closed type with inverted V-ridges is preferred. The tray may be eliminated in front of milk chest. This permits pupils of all sizes to reach milk more easily.

Sneeze Guards. Counter or sneeze guards should be provided to prevent food contamination from air-borne bacteria. These are vertical or slant shields, usually mounted with standards or brackets, with or without attached horizontal serving shelf. They should be fabricated of easy to clean materials and designed not to slow up service.

Small Equipment. For complete list of necessary small equipment and amounts of each kind needed by various size schools, see USDA Guide PA 292, pages 36–37.

Menu Board. With plastic letters or figures, or chalkboard. (Optional.)

Dish Storage. Dishes should be stored at the point at which they are used. Portable shelves or bins are recommended. These may be located in the dishwashing area and stored under the serving counter. This necessitates leaving clear space under the serving counter where the initial serving of plates occurs.

Supplies and Food Replenishments. File units with angle ledges may be provided under the serving counter for 18" x 26" pans, 12" x 20" pans or a combination of these. They may be mobile for loading in the kitchen. They should conform to sanitary regulations.

105.46 Dishwashing Facilities. The dishwashing area should be designed to (1) enable the pupils to return their soiled dishes or trays in a continuous manner, (2) dispose of waste food and trash efficiently, and (3) wash and sanitize dinnerware with minimum breakage or damage.

105.461 Location. Should be adjacent to dining area, near exit from dining area to corridors or outdoors. May be in the kitchen with sound and ventilation baffles. A separate room simplifies ventilation and noise control. Full height partitions should be used, but doors for openings may be impractical. Locate so as to eliminate cross traffic from incoming pupils.

A **remote** dishwashing area is sometimes used to insure a smoother flow of traffic from serving to eating to dish disposal without any cross circulation. The disadvantages are difficulty of supervision and returning dishes to the serving area.

105.462 Space. The floor area is determined by type and size of dishwashing equipment, counter space required for peak load periods, and traffic patterns in and out of the area. See Table 105.331 for suggested space allotment for dishwashing area in various sizes of schools.

105.463 General Construction Features, Dishwash Area. Characteristics of floor, walls, ceiling, windows and lighting should be the same or similar to those in kitchen area.

105.464 Dish Return Arrangement

a. Variations. These are: (1) walk-off adjacent to kitchen and dining room, (2) remote walk-off, as at rear of dining room, (3) conveyor belt. The first arrangement is most commonly used. The remote walk-off has certain advantages and disadvantages stated in 105.461. The use of a conveyor belt is practical but is fairly expensive.

b. Walk-off Dish Return. The dish returning may be handled by a pass-through opening into which the soiled dish scrapping counter is extended. The dish return window should be 4' to 6' wide, high enough for workers to see through. In high schools, the dish return window may be enlarged to include a few shelves where several pupils at a time may deposit trays. A short tray rail to the window is effective in controlling traffic and facilitating handling of trays and dishes by pupils.

Security. There should be some means of closing the dish return window for security and multi-use of the dining room. This may be accomplished by (1) a standard window with metal frame and opaque glass, or (2) standard double doors with 180° swing which close on the dining room side. For added security provide a latch or bolt on the kitchen side.

Finish. The wall surrounding the dish return window should be of glazed tile, plastic, stainless steel or some material which will withstand daily washing and scrubbing.

Sill Heights. The sill of the dish return counter or opening should not exceed the following heights from the dining room floor:

Elementary schools	30"
Combined schools (grades 1–12)	32"
Junior high schools	32"
High schools grades 7–12; 10–12)	34"

105.465 Size of Dishwash Counters. Suggested space:

Meal Load	Lineal Feet of Soiled-Dish Counter	Lineal Feet of Clean-Dish Counter
300–500	9	7
500–700	8 to 11*	10
700–900	9 to 12*	12 to 16
900–1100	10 to 14*	14 to 16*

*The lesser amount may be adequate for shift service. The larger amount permits some backlog stacking.

105.466 Dishwashing Operation

a. Sequence. As follows: (1) receiving, (2) scrapping, (3) disposal of wastes, (4) stacking dishes, (5) pre-rinsing, (6) washing, (7) rinsing, (8) sanitizing, (9) draining and air drying, (10) stacking clean dishes, (11) storing clean dishes, tableware, etc.

Section

b. Equipment. Suggested units of equipment are listed below:

Equipment	Total Lunches Served Daily			
	300–500	500–700	700–900	900–1000
Soiled dish table*	1	1	1	1
Pre-wash unit**	1	1	1	1
Disposals, food waste (optional)	1	1	1	1
Dishwashing machines♯				
Automatic timed door	1			
Single tank conveyor		1 or		
Two tank conveyor		1	1	1
Dish racks	8–10	10–12	12–14	14–16
Clean dish table	1	1	1	1
Water heaters	as needed to heat water supply to 140–160°F.			
Booster heaters	as needed to heat 140° water to 180°F.			
Dish trucks	2–3	2–3	3–4	3–4
Garbage cans and covers	number will vary with method of scrapping, use of waste disposal, or incinerator.			

---

*With scrap holes as needed.

♯For schools anticipating growth in excess of 500 meals served the two tank machine is recommended.

**Pre-wash sink 24" x 24" with spray or pre-wash machine.

Note: Manual Dishwashing (small schools serving less than 300). Manual dishwashing requires a three compartment sink, each compartment 20 inches by 20 inches square by 16–18 inches in depth. Long-handled wire baskets should be provided as needed (4–5) to permit emersion of dishes in the rinsing and disinfection compartments. An auxiliary source of heat must be provided to maintain water temperature of 180°F. in the last compartment for disinfection. Provide institutional type thermometer with adjustable clip to fasten on sink.

Section

c. Pre-rinse Arrangement. After scrapping plates any excess waste is handled by some type of pre-rinse arrangement: (1) pre-rinse in dishwashing machine, (2) disposal unit used for pre-rinse operation (sometimes prohibited by local ordinances), (3) pre-rinse sink.

d. Rinse Injectors add a wetting agent to the rinse line of the dishwashing machine which reduces the drying time of dishes and silverware.

e. Hot Water Supply. The general use of hot water requires 120° to 140°F. at the point of use. Dishwashing rinse water must be 180°F. at the manifold. 180 degree water may be provided by:

(1) Two-temperature water heaters.

(2) A booster heater on the rinse line of the dishwashing machine.

(3) For hand dishwashing in 3 compartment sink: thermostatically controlled auxiliary heating cycle—gas: side-arm heater, heater size 30 MBh imput—electric: 5 quart booster tank (circulating), 6 KW heater.

Section

f. Other Plumbing Features. Provide cold and hot water connections; about 20 to 25 pounds water flow pressure. Provide flow control valve in line to final rinse near dishwashing machine and provide a line strainer before the valve. Provide floor drains and other special connections as required by state and local plumbing codes.

g. Ventilation. Mechanical ventilation separate from that of the school system is required. See 252.4 b. A direct flue from the dishwashing machine is usually more effective than a vented hood.

105.47 Dining Area

105.471 Dining Room Size. In general, dining room space should be planned to accommodate one-half (small schools) to one-third of the ultimate anticipated enrollment at 10 square feet of floor area per dining room seat (elementary) and 12 square feet (secondary). Seating can best be determined by making a layout of the tables and seats and making a study of circulation. See USDA "Guide for Planning School Lunch Rooms" PA 292, page 40 for further detail.

a. Examples of Allotment of Dining Room Space (Also see 105.331).

Item	Elementary	Junior High	Senior High
Maximum (ultimate) enrollment	720	1200	1800
Number of seatings or shifts	3	3	3
Number of serving counters	1	2	3
Serving rate per minute	10	20	30
Dining room seating capacity at ⅓ of ultimate enrollment	240	400	600
Dining area in square feet:			
Area per seat	10	12	12
Dining area	2400*	4800*	7200*
Faculty dining area	360‡	600‡	960‡

*Does not include space for a stage (cafetorium).

‡Faculty dining room should have access to a corridor, a serving counter, and to the main dining room. Examples provide space for total faculty at about 12 square feet per teacher (including administrative staff).

b. Multi-use of Cafetorium. The educational program of the school is enhanced by planning the dining area for flexibility in use. Versatility may be achieved by movable partitions or folding doors or sliding partitions which divide the large dining room area into several areas. These may be used to create suitable space for educational television, large group instruction, audio-visual and other purposes. The dining area of the school lunch room may be converted into a cafetorium, with a small stage, often portable, to accommodate student groups in dramatics, debating, and music. Such a plan permits use of the gymnasium for physical education during the entire day. The dining area in an elementary school may be used as an extra teaching station for primary grade games and activities, but the multiple use of a dining area as a gymnasium is impractical and is not recommended.

Whatever the multiple use planned for the dining room area, care must be taken to provide a sound proofed partition between the dining room and the kitchen and adequate storage for the activities planned.

105.472 Equipment

a. Tables. If the dining room is to be used for other activities, portable tables and folding chairs, roll-away tables, or recessed fold-in-wall tables should be used. Where tables and chairs are used, a variety of sizes is desirable, using table heights appropriate for age level of pupils attending the lunchroom. Tables may be wood or metal, tops heat and stainproof, for seating 4, 6, or 8 pupils; self-leveling device desirable.

b. Chairs. Provide one chair per person for largest serving period. Use chair heights appropriate for age level. Folding chairs are desirable for multi-purpose use; portable racks for chair storage.

c. Traffic Aisles. For suggested arrangement, see USDA "Guide" PA 292, pages 40–41.

d. Racks and Shelves. Provision should be made in secondary schools for slatted type shelves with hook strips underneath at points of entrance to dining room for books and garments of pupils if these are to be carried to the lunch room.

e. Drinking Fountains or Water Cooler. An adequate supply of cool drinking water is necessary, preferably located away from serving line and dish return.

f. Bulletin Board. Very desirable; used for menus, seasonal decorations and educational posters; located so that pupils can see the posted materials as they enter.

105.473 Other Dining Room Detail

a. Windows. Provide same size and openable areas as required for classrooms; all openings screened with noncorrodible materials; no projecting corners on windows when opened; same type of daylight and artificial light controls as for classrooms.

b. Doors. Not less than 36 inches wide for one way traffic, 60 inches for two way traffic. Locate for orderly travel of pupils to serving area, to dining tables, to soiled dish counter, and to exit. Exit doors must be equipped with panic hardware.

c. Floor. Should be slip resistant; quarry tile, terrazzo, or resilient grease proof flooring; coved bases at walls for cleanliness.

d. Walls. Should be light in color, smooth, impervious to moisture, easy to wash and keep in good repair; glazed tile or plastic tile wainscot easiest to maintain; washable paint on hard plaster satisfactory; exposed painted masonry block units with rough surface texture acceptable for upper wall surfaces above tile or plastic wainscoting.

e. Ceiling. Acoustical type desirable; fire resistive, rodent proof, nonabsorbent, light in color, easy to wash and keep in good repair. May be prefabricated acoustical units, mechanical suspension system, or painted acoustical plaster on metal lath. Exposed concrete or painted hard plaster on metal lath is less desirable but acceptable.

f. Heating and Ventilation. See Table 241.1. Zone separately to permit independent operation.

g. Light and Power Requirements. Multipurpose dining rooms which are to be used for any instructional purpose should have light comparable to classroom footcandle requirements. Light switches should be easily accessible to groups using the unit for extra curricular activities.

Electric Outlets should be provided in the dining room for floor machines and audio-visual and other electrical equipment. These must be grounded.

105.48 Office Area. An office or planning center should be provided for the school lunch director or manager. Where load is less than 400 meals per day, a space in the kitchen for desk, chair and file may suffice.

a. Location. In the kitchen near checking point and storeroom facilities; arranged so manager has effective supervision over all preparation areas.

b. Size. 50–60 square feet; more in schools serving 1000 meals or over. See Table 105.331.

c. Finish. Same as adjacent kitchen finish, except for clear glass panels in sectional partitions. Provide outlet for telephone.

d. Ventilation. Provide good ventilation if office is a separate room. See 241.1.

105.49 Employee's Locker and Dressing Area. Storage for garments and dressing facilities are necessary for employees.

a. Location. Near the service entrance.

b. Finish. Preferably the same as the kitchen.

c. Equipment. Recommended facilities are: (1) an individual box locker with lock for each employee, (2) hanging rod, (3) low shelf for shoes, (4) high shelf for hats and packages, (5) mirror, (6) first aid cabinet, (7) lavatory with soap and towel dispensers, (8) dressing space.

d. Space. Locker room space: about 3½ square feet per employee.

e. Ventilation. See 241.1.

105.491 Toilets. Separate toilets for each sex should be provided where both men and women are employed. Minimum toilet facilities should provide one water closet and one lavatory for each ten employees. Toilets, unless off the corridor, must be completely vestibuled with two self-closing doors between water closet and kitchen. For other limitations, see Minnesota Plumbing Code, State Department of Health regulations and recommendations relating to sanitary facilities in food preparation areas, and local codes.

105.5 SCHOOL LUNCH UNIT: SPECIAL CONSIDERATIONS

105.51 Central Kitchens. There is no general concensus on the relative merits of centralized versus individual school preparation. On the one hand, a tremendous kitchen supplying a vast area is not feasible, nor can duplicate facilities, e.g., separate kitchens in a junior high and elementary school on the same site, be justified.

a. Advantages: Economy in:

(1) Building and equipment.
(2) Buying.
(3) Management.
(4) Labor. The labor cost per meal normally varies inversely with the number of meals served.

b. Disadvantages:

(1) A certain amount of individual school initiative is destroyed.
(2) Menu items are limited to those which transport and hold well.
(3) Transportation costs may outweigh other economies.
(4) There is less flexibility with changes of attendance.
(5) If disposable service is used, it becomes quite expensive.
(6) The quality of food deteriorates with the delay between preparation and serving.

c. Necessary Adaptations at Central School. Space in addition to that normally provided is needed for storing, loading and cleaning portable food containers. The nature of the space would depend on the nature of the containers, of which there are several varieties.

The truck loading area must be large enough for the scope of this activity. There should be no steps between truck loading and food preparation. Doors should be wide enough for the equipment used. The loading area should be roofed for inclement weather.

d. Necessary Facilities in Satellite Schools. The same conditions necessary for loading food carts at the central kitchen should prevail for unloading at the serving school. There are still some basic essentials for this type of service:

(1) Dishwashing facilities.
(2) Storage space for paper goods and cleaning supplies.
(3) Refrigerator for holding salads, cold desserts, butter, etc.
(4) Serving equipment, including milk chest. In some cases the same mobile units are used to transport and serve food.
(5) Manager's desk for the necessary accounting procedures.
(6) Employees' lockers and toilets.
(7) Garbage collection and can-washing area, or incinerator.

105.52 Selection and Procurement of School Lunch Equipment

105.521 Selection

a. Quality. Cheap equipment becomes expensive through rapid depreciation. Stainless steel should be used for sinks, counter tops, work tables, soiled and clean dish tables. It will normally last the lifetime of the building and will reduce labor costs. For these purposes 14 gauge, No. 4 finish, 18–8 or type 302 stainless steel is recommended. In writing specifications, trade names may be used as a standard of quality.

b. Availability of Servicing Agencies. Repair and maintenance service available on mechanical equipment may determine its acceptability.

c. Established Standards. Standards which have been established by various agencies should be incorporated in the equipment specifications. Examples of equipment identified by seal of approval:

(1) National Sanitation Foundation, Ann Arbor, Michigan:
  Food Service Equipment—Standard No. 2.
  Spray Type Dishwashing Machines—Standard No. 3.
  Gas and Electric Commercial Cooking and Warming Equipment—Standard No. 4.
  Commercial Refrigerators and Freezers—Standard No. 7.
(2) American Gas Association—Gas Equipment.
(3) Underwriters Laboratories—Electrical Equipment.
(4) American Society of Mechanical Engineers—Steam Equipment.

d. Advantages of Standardization. The problem of procurement and services are simplified by limiting the number of makes of equipment. Service charges are usually less when this is done.

105.522 Procurement and Installation. The method of procuring and installing equipment varies. In general the following practices are recommended:

a. Construction Contract Items. Items which are attached to the building should be in the construction contract. This may include: sinks, dish tables, dish machines, hoods, stationary shelving, mop racks, soap, towel, and toilet paper dispensers, lockers, mirrors, bulletin board, build-in serving and work counters, exhaust fans, water heaters, booster heaters, grease traps and walk-in refrigerators or freezers or combinations.

b. Other Fixed Equipment. Other fixed equipment such as ranges, ovens, steamers, steam-jacketed kettles, some peelers and mixers, may be included in the construction contract or contracted separately by the school board. The advantages of having these items in the construction contract is that the contractor becomes responsible for coordinating both the delivery and the installation.

c. Items Purchased Directly by the School Board. When equipment is purchased directly and separately by the school board, it should be installed by the construction contractor. The equipment contractor should deliver to the site, uncrate and place ready for connecting. Delivery time should be included in the specifications. It is desirable to require the equipment contractor to instruct employees in the use of equipment. This should be included in the contract.

d. Codes. The architect should have access to state and local codes which affect the installation of mechanical equipment.

105.53 Equipment Lists and Recommendations. Refer to:

(1) Appendix: (105.6) at the end of this Section.
(2) "Guide for Planning and Equipping School Lunchrooms" PA 292 U.S. Department of Agriculture, Agriculture Marketing Service, Washinggon, D.C.
  Copies are available, in limited number from Department of Education, School Lunch Section.
(3) "School Lunch Journal" The American School Food Service Association, P.O. Box 8811, Denver 10, Colorado. January 1962, pages 50–53.
(4) "Planning and Equipping the School Lunchroom." The University of the State of New York, The State Education Department, Division of School Buildings and Grounds, Albany, 1963.

105.54 Adaptations for Handicapped Children. Where school lunch facilities are provided for physically handicapped children the serving counter aisle and entrances should be a minimum of 3′ for wheel chairs and for pupils using crutches. Changes in floor level should be avoided.

105.55 Emergency Feeding in Civil Defense (Survival Preparedness) Programs.

The national plan for Civil Defense recommends that schools maintain stockpiles for mass emergency feeding for at least two weeks following a disaster. This may be taken into consideration in planning new school lunch facilities. Refer to: "Good Stockpiling for Emergency Shelters" prepared by Commodity Stabilization Service, U.S. Department of Agriculture, Washington, D.C.

Subterranean Lunch Facilities. Consult with the Director of School Building Planning and Development, Department of Education.

105.6 Appendix: Major Equipment Requirements for School Kitchens (Minimum)

No. of Complete Lunches Daily:	(350–500)	(500–750)	(750–1,000)	(1,000–1,500)
COOKING EQUIPMENT[1]				
Ranges, heavy duty sections, approx. 36″ x 38″ or larger with oven	1 or 2 sections	1 or 2 sections	1 section (plus convection ovens)	1 section
Convection oven (usually 5 shelves, each holding two 12″ x 20″ pans)	one	1 or 2	two	2 or 3
Steam jacketed kettle (may be in combination with compartment steamer)	one 30–40 gal.	two 30–40 gal.	two 40 gal.	two 60 gal. or one 40 gal. & one 60 gal.
Compartment steamer, capacity to accommodate four 12″ x 20″ x 4″ pans per compartment	1–2 compart.	2–3 compart.	2–3 compart.	2–4 compart.

---

[1] Combination of range, oven and steam equipment may be varied to provide equivalent capacities depending upon preferred method of cooking. Hood ventilator and water connection should be provided for cooking unit.

No. of Complete Lunches Daily	(350–500)	(500–750)	(750–1,000)	(1,000–1,500)
TABLES[2]				
Receiving (24″ to 30″ wide), may be portable	one 4′–5′	one 4′–5′	one 5′–6′	one 5′–6′
Cook's (with ceiling hung pan racks, shelves below, and 2 drawers,[3] 30″ wide)	one 6′–7′ with sink 15″ x 15″ x 12″	one 6′–7′ with sink 15″ x 15″ x 12″	one 6′–9′ with sink 15″ x 15″ x 12″	one 6′–9′ with sink 15″ x 15″ x 12″
Salad-sandwich (with shelf below and one 10″ shelf above top; drawers 30″ wide)	one 4′–5′	one 5′–6′	one 5′–6′	one 5′–6′
Baker's (with portable bins and drawers 30″ wide)	one 4′–5′	one 5′–6′	one 8′	one 8′
Vegetable preparation, (with shelves and drawers 30″ wide)	one 6′–8′ desirable	one 6′–8′	one or two 6′–8′	one or two 6′–8′
Multipurpose Portable	(Desirable for all size units)			
SINKS				
Vegetable (two compartment, approx. 48″ x 24″ x 14″)	one	one	one	one
Pot and pan (three compartment, approx. 72″ x 24″ x 14″)	one	one[4] (large and deep enough to immerse pans)	one[4]	one[4]
Pre-rinse (See dishwashing equipment)				
Cook's (See Cook's table)				
Hand (Soap and towel dispenser)	one	one	one or two	one or two
DISHWASHING EQUIPMENT				
Dishwashing machine	One tank (rack conveyor type)	Two tanks (rack conveyor type)	Two tanks (rack conveyor type)	Two tanks (rack conveyor type)
Pre-wash with spray	Sink 24″ x 24″, or disposer	Sink 24″ x 24″, disposer, or pre-wash machine	Sink 24″ x 24″, disposer, or pre-wash machine	Sink 24″ x 24″, disposer, or pre-wash machine
Garbage disposer[5]	Optional	Optional	Optional	Optional
Rinse injector	One	One	One	One
Soiled dish table (30″ wide)	Approx. 9 linear ft.	Approx. 9 linear ft.	Approx. 11 linear ft.	Approx. 14 linear ft.
SERVING				
Counter 30″ wide with tray rail (space for portable trucks underneath)	18′–20′ 1 for Elem. 2 for H.S.	Two, 18′–20′	Two or three, 18′–20′	Three, 18′–20′
Hot food inset (opening for pans, 12″ x 20″ by 8′, with individual heat control)	4 pans per counter	4 pans per counter	4 pans per counter	4 pans per counter
Cold food section, plain counter top (shelf above, cart storage underneath)	6′ per counter	6′ per counter	6′ per counter	6′ per counter
Tray stand[6]	One per counter	One per counter	One per counter	One per counter
Cashier's station (see Sec. 105.452 c.)				

---

[2] Allow approximately 4 linear feet of table top for each food production employee. Can opener attached to a portable table is convenient. Space beneath tables for carts is desirable.
[3] One drawer fitted for knife storage, preferably with locking device.
[4] Consider mechanical flush equipment for 500 or more meals.
[5] Disposers add load to sewage system and must be considered in design of system. Some local codes prohibit their use. .
[6] Tray stands should be portable, located at beginning of serving counter.

No. of Complete Meals Daily	(350–500)	(500–750)	(750–1,000)	(1,000–1,500)
REFRIGERATION				
Reach-in (consider walk-in when more than 60 cu. ft.)	20–40 cu. ft.	40–60 cu. ft.	60 cu. ft.	60 cu. ft.
Walk-in (Minimum 80 sq. ft. or 8′ x 10′)	Approx. 8′ x 10′	Approx. 8′ x 10′	Approx. 8′ x 12′	Approx. 10′ x 14′
Frozen food storage (minimum walk-in 80 sq. ft. or 8′ x 10′)	Approximately the same space as for refrigerated storage. Will vary with local purchasing and delivery programs and size of school.			
Milk service (located in or near counter)	1 cu. ft. capacity for 50 cartons. Bulk storage in cooler, unless dispenser at milk station.			
KITCHEN MACHINES				
Mixer with bowl adapter and attachments[7]	One 20–30 qt. pedestal type (& extra bowls)	One 60 qt. (30–40 qt. adapter) pedestal, plus 12 qt. table model	One 60 qt. (30–40 qt. adapter) pedestal, and one 12–20 qt. table model	Two 60 qt. (30–40 qt. adapter), pedestal type, & one 12–20 qt. table model
Food chopper	Omit (add grater & slicer mixer attachments	One pedestal type	One pedestal type	One pedestal type
Meat slicer	One, semi-electric, 9″ cutting capacity	One, semi-electric, 9″ cutting capacity	One, semi-electric, 9″ cutting capacity	One, semi-electric, 9″ cutting capacity
Portable equipment Utility trucks, approx. 22″ by 3′ with shelves	Number and size depends upon kitchen layout			
Racks:				
Cooling—portable, 4 to 6 slatted shelves or angle slides	Number depends on local needs, amount of baking, etc.			
Utensil—portable, 4 to 6 slatted shelves	Number depends on local needs, amount of baking, etc.			
Platform truck	One	One	One	One
Bins on casters or dollies for cans	As needed	As needed	As needed	As needed
Enclosed holding cabinet for hot or cold food	One	One	One	One or two
OFFICE				
Desk and chair	One	One	One	One
File cabinet	One	One	One	One
SCALES				
Portable floor model[8]	One	One	One	One
Table model[9]	One	One	One	One

---

[7] A table model mixer may be set on a portable cabinet, equipped with brake, for the storage of attachments.
Maximum 400 pound capacity, one-quarter to one-half of a pound graduation.
[9] Commercial type, 25–30 pound capacity, one-quarter to one-half an ounce graduation, platter top desirable.

SECTION 106.0 AUDITORIUMS AND STAGES

Section

106.1 General. Auditoriums are included as essential parts of secondary school plants due to a broadening of the educational program to include assemblies, dramatics, music, lectures, and by the increased use of such space by community groups. The school auditorium is often the only available seating space with stage facilities and as such can become a major community property and center of interest in the school.

With the development of new media and techniques for large group instruction, some schools have provided a divisible multi-purpose teaching auditorium. Such a facility is designed to provide a single auditorium station of capacity suited to the school and community and within this large space a number of teaching stations for capacities of 125–200 pupils, obtained by the use of movable soundproofed partitions.

106.2 Size. The size of auditoriums will be governed by the size of school enrollment, the school policies and program, the extent of community use, and the availability of other such facilities in the community.

a. From the standpoint of school use, an auditorium of 500–600 seating capacity and an adequate stage may be suitable for school purposes in all but the largest schools. Such larger schools may find it advisable to provide both an auditorium and multi-purpose room with stage. They may also consider the divisible, multi-purpose auditorium.

b. Balconies are not recommended for auditoriums seating less than 800 persons. A desirable maximum number of persons who can see and hear adequately on one floor is about 800 persons, preferably 700. Where more than 700 persons are to be seated, a balcony may be considered.

106.3 Location. The auditorium should be located in proximity to the art, music and drama rooms, to dressing rooms, to toilets, to public access and parking areas, and for good internal circulation. Partial isolation from the rest of the building is recommended for ease of access to the general public, increased safety to crowds entering and leaving the auditorium, access to parking space, easier zoning of heating and ventilation, and reduced sound interference with the rest of the school program.

106.4 Facilities Needed. All auditoriums should have: a lobby with a toilet access, a properly sloped seating floor, a flat orchestra space, a forestage or apron, proscenium and curtain, backstage, adequate off-stage wings, projection station(s), and proper lighting.

Well-equipped auditoriums should provide a ticket booth, cloakroom or other space for this purpose, a display case and a telephone booth in the lobby. Additional facilities for stage production will be dressing room facilities, toilets, and storage for scenery flats and other properties. A workshop for the construction of scenery is considered essential by many secondary school planners.

For the auditorium divided into instructional areas by movable partitions, the seating, lighting, and storage problems must be evaluated to determine specific needs. Careful attention must be given to the zoning of lighting. The seating units may have swing-down tablet arms or some other device for writing or notetaking. There may be advantages in the use of swivel seats. Study must be given to the types of equipment and the material which are planned for these areas. If portable carts are used as projection stations for the divided areas, each must be stored to facilitate its movement out of the line of sight when partitions are opened for full auditorium use.

106.5 Seating Area

106.51 Seating and Aisles

a. The number and arrangement of fixed seats, aisles and cross aisles must conform to the Fire Marshal's requirements and local ordinances.

b. Seating should be arranged with a minimum of 32" back to back for fixed wood back seats and 34" minimum, upholstered seats. The width of fixed seats may vary from 19" to 24", but not less than 19".

c. Aisles with seats on both sides should have a minimum effective width of 30" and an increase of 1½ inches for each 10 running feet.

106.52 Floor. A sloped floor is desirable in auditoriums with a seating capacity over 300, or if the room is not a combination auditorium-gymnasium. Where the slope is greater than 1½ inches per foot steps are required beyond the sloping portion of the floor for proper viewing of the stage and projection screen.

106.53 Balcony. If provided, balcony seating capacity should not exceed twenty-five percent of the total auditorium seating. Seating capacity should be calculated the same as required for the main seating area. The balcony must be provided with at least two exit doorways opening directly upon a corridor. Stairs from the balcony should discharge into the lobby or a corridor and not into the auditorium.

106.54 Windows. Windows are of little use in an auditorium and should be omitted to save cost. Any necessary window darkening material used should be opaque, fire resistant, fade resistant, light, durable, easily manipulated and easily cleaned.

106.55 Acoustics. An acoustical engineer should be consulted to insure proper planning of the physical design and acoustical properties of the auditorium or multi-purpose auditorium.

106.56 Exits and Exit Doorways. Exits and exit doorways and exit illumination and signs must be provided in accordance with the Fire Marshal's requirements. See Section 125.

106.57 Motion Picture Projection. Auditorium type projection equipment will usually necessitate a machine that is not adapted to other use. A small booth to house the projector with large glass windows and sound insulation should be provided. The area may also be enclosed by glass partitions; a full booth is no longer considered necessary.

a. In small auditoriums or in sub-divided areas of auditoriums a moderately elevated projection area (about 6 sq. ft.) should be provided, with a ramp for rolling projection stands. This area may be portable to permit other uses of the space it occupies. Adequate storage for film, parts, and equipment should be provided in or near the area.

b. The projection booth should be designed so that the light beam of the projector will clear people in the auditorium whether seated or standing.

c. A projection station should be provided in the center of the auditorium, 15–25 feet from the screen for the use of short range projection equipment. Provide a covered outlet.

d. Controls and switches in the projection area should be convenient to the projectionist.

106.58 Screen. A screen suitable for showing still and motion pictures should be provided, preferably motorized, with "key" controls for raising and lowering.

a. Screen size and distance of front and back seating should be determined to establish an appropriate ratio between size of screen and distance of seating from the screen Normally the front row of seating should be about two screen widths from the screen and the back row about six screen widths from the screen.

b. The ceiling and (or) the proscenium arch should be high enough to accommodate a screen suitably large for the size of the auditorium.

c. The screen should be tilted, if necessary, so that it is at right angles to the central light beam of the projector.

106.59 Lighting. Artificial lighting in the seating area should be soft, even and devoid of glare, with control permitting a gradual reduction to about one-tenth of a foot-candle at seating level. Controls should be provided on the stage and at the projection booth or area.

106.6 ORCHESTRA SPACE. The space in front of the stage should be 12′ to 16′ wide with a flat floor meeting the sloped floor of the seating area. It should be kept to a minimum necessary to accommodate the instrumental music unit.

106.7 STAGE. Four major stage arrangements currently used are: (1) "proscenium" type, (2) "platform" type—similar to proscenium except stage projects into audience, (3) "open" type—where actors are surrounded by audience, and (4) "Arena" type, depressed, seats surrounding the stage, often as carpeted steps or raised bleachers. Proscenium type stages are formally divided into the following areas:

Forestage or apron: space in front of the curtain and proscenium.
Backstage: space behind the proscenium.
Offstage or wings: space on either side of the backstage.

106.71 Circulation. The following access should be provided:

a. Backstage to auditorium, preferably on both sides.

b. From wing to opposite wing behind rear curtain.

c. Backstage, without passing in view of the audience to:

(1) Music, art (stage craft) drama area, direct or by corridor, on the same level, if possible.
(2) Scene dock or scenery workroom, same level.
(3) Loading door for trucks, through scenery room, if any.
(4) Dressing rooms or classrooms used for dressing rooms, and to toilets, direct or by corridor.

NOTE: Extra high and wide doors should be provided for moving properties, piano, and bulky stage materials from storage spaces or workroom to stage.

106.72 Forestage. The apron should be slightly curved. It may extend considerably to the side, but usually terminates at the proscenium. Access to the forestage from one or both sides of the orchestra space without going behind the curtain should be provided. The height of the forestage from the low point of the flat orchestra floor will vary from 32″ to 36″ for small auditoriums to 36″ to 42″ for large auditoriums. The apron floor is of hardwood.

106.73 Backstage. Ceiling over the stage should be designed to facilitate hanging of equipment from joists or pipe hangers. Ceiling height should be at least 8′ above proscenium opening. In large secondary school auditoriums, stages with gridirons for vertical lifting of scenery may be desirable if big community productions are commonly staged, but usually are not necessary. Gridirons, if provided, should be 60 feet or more in height from the stage floor.

The backstage FLOOR should be edge grained soft wood for easy mounting of props. The floor should be clear of obstructions, including radiators and electrical equipment.

106.74 Stage Wings. Stage wings should be clear floor area, full length of backstage. Any dressing rooms, storage rooms or permanent equipment adjacent to the stage should not infringe on the offstage spaces on either side of the stage.

106.75 Dressing Rooms. Dressing rooms should be on stage level if possible. They should be equipped with benches, costume racks, lockers, and lavatories with hot and cold water. Convenient classrooms may serve for dressing and make-up rooms. If so used, they should be provided with screens for changing costumes in privacy and a lavatory with hot and cold water. Toilets should be convenient to but preferably outside dressing rooms.

106.76 Stage Size. Stage size should be suited to stage functions and the activities to be performed on it. Suggested state dimensions for a proscenium type stage for small to average size auditoriums are as follows:

	Stage Depth		Proscenium		
Auditorium Seating Capacity	**Forestage**	**Backwall to Curtain**	**Width**	**Maximum Height**	**Offstage Wings Each Side**
300–400	5′	25′	24′	18′	12′
400–500	6′	26′	26′	18′	15′
500–600	8′	28′	30′	20′	15′
600–800	8′	28′	35′	20′	20′

NOTE: For large auditoriums for secondary schools, the minimum stage depth should be 30 or more feet and the offstage wings at least 20 feet. The proscenium width should seldom be more than 35 feet.

106.77 Stage Lighting. Many schools have eliminated footlights and border lights and have substituted spotlights supplemented by light from ceiling ports in front of the stage. There should be outlets on the stage for floodlights and spotlights. If footlights are used, they should be underwriters approved, disappearing or removable type. There should be a light panel for controlling stage lights, with sufficient circuits and dimmers for flexibility. There should be separate dimmers for the house lights.

106.78 Electrical Requirements

a. Duplex electrical RECEPTACLES fed by multiple circuits independent of the house lights and fused for 30 amperes should be placed:

(1) Every six feet along the base at the front of the stage.
(2) At least two in each wing of the stage.
(3) Two at the back of the auditorium and one half-way back, or one-third and another two-thirds of the way back in larger auditoriums.
(4) Four in the projection booth or, in smaller auditoriums without a projection booth, two in the elevated projection area.

b. SPEAKERS should be wired with imputs so they may be fed by the central sound system, public address, motion picture projector, record player, and tape recorder player without using long connection cords.

c. IMPUTS FOR SOUND TRANSMISSION should be located beside all power outlets for projection and sound equipment. These imputs should connect with speaker cables leading to an amplifier and from there to the permanent speakers.

d. A booth or cage should be provided in one wing of the stage to house CONTROLS for the central sound or television system, the public address system, and recording equipment. Controls for the curtain, screen and lights should be provided in the same area, possibly in the same booth or cage. Controls for the house lights should also be provided in the projection area at the rear of the auditorium, or in smaller audiroriums at the elevated projection areas.

e. TELEPHONE OR INTERCOM should be provided between the stage control center and the projection booth, dressing rooms, choral room, band room, and properties room.

f. Permanent, shielded cables for low impedance MICROPHONES should be installed at approximate ten-foot intervals across the front of the stage. One should also be installed at the back center of the stage; at the center, front and back, of the auditorium, and half-ways back (small auditorium) or one-third and two-thirds of the way back (large auditorium) for audience participation.

g. TELEVISION conduits leading to appropriate listening stations in the school building should be installed to permit originating closed circuit television programs from the auditorium stage. A coaxial television line connecting with the closed circuit studio, if provided, should be installed and connected to at least three access points on the auditorium stage. Circuiting should be planned to permit use of the auditorium for large group viewing of programs originating elsewhere.

106.79 Other Considerations

a. STORAGE. Adequate storage should be provided in the wings for stage sets, properties, and other materials. Protected storage should be provided for piano.

b. STAGE ROPES. These are dangerous and should be covered.

c. FIRE SAFETY

(1) Two means of exit from the stage should be provided with wide doors to corridor or outside for moving properties. The stage should not be used as a part of an exitway from a dressing room.
(2) Flameproof curtains, drops, cyclorama sections, flats, etc., must be provided.

106.8 PUBLIC TOILETS. These should be located off the auditorium lobby, vestibule, or corridor. They should be situated so as to eliminate the need for access to the rest of the building. In small schools, general toilet rooms should be convenient to the auditorium and the classrooms.

106.9 GYMNASIUM-AUDITORIUM. Separate gymnasiums and auditoriums are desirable for maximum use, but where funds are not available to provide both separately they may be combined. In smaller schools the cafetorium may solve the problem. See 106.91. If the gymnasium-auditorium combination is necessary, the following precautions are desirable:

(1) The stage may be located along one side of the gymnasium with folding bleacher chairs nearby. Successful designs have also located the stage at one end of the gymnasium.
(2) Provide a storage room off the stage wings for storing stage scenery, properties, equipment, and materials. Storage for folding chairs may be provided under stage.
(3) Provide heating and ventilating adapted to the needs for physical education and the different demands when the room is used as an auditorium.
(4) Provide sufficient and convenient storage space for physical education equipment.
(5) Provide acoustical treatment for auditorium use.
(6) Consider use primarily as a gymnasium for physical education with occasional use for assemblies and dramatics. If a multi-purpose room with stage is provided elsewhere, a permanent stage is not essential.

106.91 Cafetorium. The conversion of the dining area of the school lunch room into a "cafetorium" by adding a small stage, often portable, to accommodate pupil groups in dramatics, debate, choral music, visual aids, and assembly of a portion of the school's pupils has merit. Such a plan permits the use of the gymnasium for physical education during the entire school day. Whatever the multiple use planned for the dining area, care must be taken to provide a sound insulated partition between the kitchen and the dining room and adequate equipment, storage, sound and light control for the activities planned.

107.0 ASSEMBLY AREAS AND STAGES IN ELEMENTARY SCHOOLS

The statements in Section 106 generally apply. However, multipurpose rooms rather than single-purpose auditoriums are usually found in elementary schools. See Section 57.3, "Stages" in elementary school assembly areas. See, also, Section 57.31 "Portable Stages."

108-109 Reserved for future use.

SECTIONS 110-119. SERVICE FACILITIES

SECTION 110.0 FACILITIES FOR MECHANICAL-ELECTRICAL EQUIPMENT MAINTENANCE AND SCHOOL PLANT CUSTODIAL SERVICES

110.1 General. This section involves facilities for the implementation of desirable school building operational and maintenance services. In general, these services are:

(1) Mechanical-electrical equipment maintenance service.

(2) School plant custodial services, involving housekeeping and sanitization within the building and care of the external grounds and athletic fields.

110.2 Mechanical-Electrical Equipment Maintenance. Up to 25–30% of the basic contract cost of public school buildings is invested in mechanical and electrical equipment provided for servicing the building. Much of the operating equipment is controlled by automatic mechanical and electronic controls protecting not only the building and contents, but more importantly, the safety of the pupils and teachers in the building. It is also a matter of experience and record that appropriate preventative and improvement maintenance will save costly equipment repairs and yield required safety standards for the building and occupants.

110.21 Work Description. Mechanical-electrical equipment maintenance includes the checking of operating equipment from master data and control panels, and the cleaning, lubricating, testing, adjusting and maintaining of all operating equipment and control mechanisms in the building. It has to do with boilers, burners, blowers, air compressors, circulating pumps, unit ventilators, unit heaters, electric or pneumatic controls, valves, sensing units, safety controls, electric motors, garbage disposals, dishwashers, water heaters, clock and bell systems, dust collecting and air treatment units, instructional equipment that is not maintained by teachers, and more.

110.22 Personnel. A mechanical-electrical equipment maintenance man should be a person with high mechanical aptitude, training in one or more of the trades at a vocational or trade school and work experience in one of several trades related to school plant equipment maintenance. He should have a Class A engineer's license. It is recommended that such a person be assigned to a school building full time or on a field or itinerant basis, depending upon the size of the building and the amount and type of equipment in the building. This relates to the number of pupils served in the building and the grade level of the pupils—senior secondary, junior secondary or elementary. Local administration should determine the work load and responsibilities of this position.

Note: Roughly, a senior secondary school of 2000 pupils would require a full time mechanical-electrical maintenance man; a large junior secondary school, one-half or more of his time; and a large elementary school from one-third to one-half of his time. In a one-building school system, this man would be assigned some additional duties.

Such maintenance would also include the keeping of an up-to-date log of all routine maintenance performed. The log would have space for dates that motors were oiled, filters were changed, etc. The log would also indicate the recommended intervals of time that should elapse between maintenance operations for each piece of equipment. The log Section should not be confused with the maintenance manual which should also be required.

110.23 Facilities. Facilities for the mechanical-electrical equipment maintenance man include a master equipment indicator panel and control center, work room, and a small office area.

a. Indicator Panel and Control Center. In this center, an electronic indicator panel indicates the location and operating condition of all significant remote heating, ventilating and air conditioning equipment and the temperature of every space in the building with a thermostat. Most of the desired adjustments in heating and cooling can be made directly from the panel. This center, essential in large school buildings, is usually located adjacent to the space containing the mechanical equipment.

b. Workshop. The workshop should be located centrally in respect to the boiler room and mechanical equipment room. It may also have access to the receiving and storage area. The workshop should be isolated from the instructional areas. It should be available to the custodial staff for minor repairs.

Size and Equipment. The size will vary with the amount of equipment and level of maintenance services to be maintained. Ample space should be provided for the work areas and equipment and tools needed, cabinets, bins, racks, and storage. Adequate and appropriate electrical outlets for the electrical tools and equipment should be provided, as well as sink, water and gas services. Work areas involving welding or other use of flammable materials must meet the Fire Marshal's standards.

c. Office. An office adjacent to the workshop and with access to it may be provided for a full-time mechanical maintenance man. It should provide space for a desk, chair, files, storage cabinet for special or expensive tools, and a bookcase for the maintenance manuals. About 75–100 square feet of floor area is suggested. For field or itinerant mechanical maintenance man, an office area in the workshop may suffice. A telephone should be provided in the office area.

110.24 Electric Switch and Meter Room. A separate room should be provided for main service panels with main service switches, meters, and main light and power panels. The room should be located where it can be reached readily in case of fire or emergency. It should be completely enclosed and under lock and key control.

Note: For most efficient electrical service, the placement of power transformers in the building is recommended.

110.3 Custodial Services

110.31 Work Description. The responsibilities of the custodial staff will be affected by the local organization of the custodial program, but usually include the following operations both inside and outside the building:

The preservation of the physical school plant.

The continual maintenance of a safe and healthful en-

Section

vironment for pupils and teachers. (Housekeeping and sanitization)

The storage of all school sanitary and cleaning supplies.

The receiving, inventorying, storing, shifting of all unattached equipment.

Taking care of loose hardware and making minor mechanical repairs.

The care and maintenance of grounds and athletic fields. This may be delegated to specialists in a large school system.

110.32 Estimating Custodial Staff. In general, one custodian working 8 hours will serve 200 pupils. A large school of 2000 pupils will require about 10 custodians; a school of 400 pupils, two custodians; a school of 500 pupils, 2 custodians and a one-half time custodian. Local conditions may affect this ratio.

110.4 CUSTODIAL FACILITIES. Custodial facilities will normally include:

- Facilities for general building maintenance
  - Janitor's closets
  - Janitor's storage
- Central custodial facilities
  - Receiving and shipping area
  - Custodian's supply room
  - Flammable products storage
  - Custodian's office
  - Employee dressing rooms and toilet
- Incinerators
- Outdoor equipment storage.

110.41 Facilities for General Building Maintenance

a. JANITOR'S CLOSETS. A janitor's service closet, including a sink, should be provided on each floor of the building, convenient to general toilets, one for about each 7,500 to 10,000 square feet of floor area. A janitor's closet should be provided for spaces requiring special maintenance equipment and supplies, such as gymnasiums, auditoriums, shops, and multi-purpose rooms.

In most locations the janitor's closet should be provided with service sinks. A recessed floor slop receptor approximately 8" deep with no curb and a good drain is recommended. A space of at least 60 square feet is needed to accommodate mops, brooms, mop pails or mop wagon, scrubbing machines, vacuum cleaners, polishers, detergents, and a step ladder. A hook strip for hanging mops and brooms and several shelves for supplies used in cleaning should be provided.

b. JANITOR'S STORAGE. A ventilated storage space located convenient to the general toilets or as part of the janitor's closets on each floor should be provided. It should be equipped with adjustable shelves for storing of housekeeping items needed nearby such as paper toweling, toilet tissue, soap, and light bulbs, as well as cleaning supplies and equipment.

110.42 Central Custodial Facilities

a. RECEIVING AND SHIPPING AREA. A space for receiving, unpacking and distributing incoming supplies and equipment adjacent to or in a storeroom should be provided. May include an outside loading platform. See Sec. 105.41 School Lunch for details of loading platform.

b. CUSTODIAN'S SUPPLY ROOM. Storage space for building supplies and maintenance equipment (non-flammable) should be provided accessible from the receiving area.

c. FLAMMABLE PRODUCTS STORAGE AND PAINT ROOM. A room constructed as recommended in NBFU Pamphlet No 30 "Storage Handling and Use of Flammable Liquids Appendix A," should be provided for the storage of flammable products used for building maintenance, such as paints, oils, grease cleaning compounds and materials. The room may contain a painting area.

d. CUSTODIAN'S OFFICE. In schools with 750 or more pupils, a custodian's office for the filing of requisitions, schedules and records should be provided. An area of about 75-100 square feet will provide space for desk, chair, files, storage cabinet, bookcase and telephone.

e. WORKSHOP. The mechanical maintenance man's workshop will be available for minor custodial repairs. If such a person is not provided, provide this area as described in Sec. 110.23.

f. EMPLOYEE DRESSING ROOMS AND TOILET. Minimum facilities should include a locker for each employee and one water closet and lavatory for each ten employees. Such facilities should be separate from the toilet facilities provided pupils.

Toilet facilities for MALE employees, including the chief custodian, should be located adjacent to the workshop or boiler room, or to the custodian's office, when provided.

FEMALE employees should be provided with a dressing room individual lockers, and a toilet adjacent to the dressing room with a water closet, lavatory with hot and cold water, first aid cabinet, mirror and accessories.

110.43 Incinerators. Incinerators or destructors in school buildings should be located and installed in accordance with the current standards of the National Board of Fire Underwriters for incinerators (NBFU pamphlet No. 82). See Fire Marshal's Standards, Sections 133.1-133.5. Some custodial people are recommending outside type incinerators with inside loading so that final refuse may be loaded into trucks without any intermediate transfer or carry.

110.44 Outside Equipment Storage. Storage space should be provided for site maintenance equipment as necessary. The storage space should be dry, convenient to the grounds, accessible by service trucks and have doors to accommodate wide equipment. It should have ample space for planting materials and mowing equipment; snow removal equipment; masonry and surfacing repairs; playground equipment repairs (elementary schools); and water connections for mixing materials and cleaning tools.

The following equipment or similar items indicate storage needs: mower, multiple gang type and small rotary mowers; rollers; snow removal blowers or a small tractor for year-round work; ladders; wheelbarrow; spreaders and sprayers; hose sprinklers or extension piping; a variety of tools; spades, shovels, rakes, forks, trimmers, trowels, pruning hooks and shears, etc.

The outdoor equipment storage space should be accessible only from outside the building. A separate small building may be preferable if water and electricity are available.

110.5 MAINTENANCE MANUALS. See Sections 27, 239, 282.3.

110.6 MISCELLANEOUS CUSTODIAL NEEDS. Consideration should be given to the safety of the custodians in their work. Labor saving equipment will be a source of economy. In large multi-storied building, an elevator should be provided unless convenient outside grade entrance is available to each floor.

110.7 HEATING AND VENTILATING. See sections 120–149 State Fire Marshal's Standards and sections 230–259 Heating and Ventilation.

110.8 ELECTRICAL. Grounded receptacles should be provided in the boiler room, mechanical equipment room, indicator panel and control center, electric switch and meter room, workshop, receiving and storage areas, and offices provided. Power outlets should be provided in the workshop for electrically operated tools. Receptacles or outlets for clocks are desirable in the boiler room, mechanical equipment room, workshop, and offices.

Suggested artificial lighting levels: boiler room, mechanical equipment room, electric switch and meter room, receiving and storage rooms—20–25 footcandles; offices—50 footcandles; workshop and indicator panel and control center 70 footcandles.

SECTION 111.0 SCHOOL BUS GARAGES

Section

111.1 Scope. The continuing enlargement of school districts and increase in school population necessitates fleets of buses to transport pupils living beyond walking distance to schoolhouses. The planning of safe and economical housing of school buses by school districts is an attendant problem.

Before even preliminary plans are prepared for the bus garage, careful consideration must be given to the following and other factors:

(1) Number and size of buses for which housing is needed currently and for the foreseeable future.
(2) Number of storage stations.
(3) Number of service stalls and services to be provided: fuel, oil, tires, wash, maintenance repairs and others.
(4) Heating, ventilation, electrical and utility services needed.
(5) State Fire Marshal's Regulations governing the handling, storing, and transportation of flammable liquids, including No. 612-03, "Service Pits."

111.11 Use of "Registered" Planning Personnel. It is a statutory requirement in Minnesota that plans and specifications for any public work or any public improvement the total cost of which exceeds $2,000 shall be prepared by registered architects and engineers. (M.S. Sec. 326.03)

111.2 Selection of Site. Few schools have enough ground area to permit location of a bus garage on the school site.

Every effort should be made to secure a garage site physically separated from the school site by a block or more, with good drainage, access, and possibility of future additions.

Attachment of a bus garage to a school building too often limits expansion of the garage, limits extension of the school building, increases fire hazard, and makes it necessary for school buses to cross playgrounds or other areas accessible to pupils, thereby increasing hazards to pupil safety. Such attachment is no longer approved.

Placement of the bus garage on a site physically separated from the school site eliminates the objections listed above, permits use of less expensive or pre-engineered construction and removes a potential nuisance from the vicinity of the school building.

111.3 General Design of Bus Garages. Features:

(1) A bus garage should be planned as a series of bus storage stations, each to house a bus, or a series of buses, and to be served by an overhead door 11′ or 12′ wide and not less than 10′ in height. A "drive through" type is proving very functional providing location and site conditions will permit this type.

(2) Width of storage stalls should be 12′ center to center.

(3) If buses are to be greased or repaired, one or more stalls at least 16 feet wide are needed. Such stalls can serve for storage as well as for maintenance. It is desirable to separate the repair stall from the remainder of the garage by a full-height partition.

(5) Length of single storage spaces should be not less than 42′ for 48–54 passenger buses.

(6) A minimum ceiling height of 12′ to accommodate overhead type doors and hardware is required. Repair stall ceiling height should be sufficient to permit use of hydraulic or mechanical lifts if such equipment is to be used; or for installing an overhead beam or rail.

(7) A concrete threshold for entrance doors is essential, and a concrete apron of suitable size and slope should be provided in front of the entrance doors. A concrete floor is recommended, with added hardener to prevent chipping and penetration of grease. Both floors and apron should be reinforced and of sufficient thickness to carry weight of buses.

(8) Walls, partitions, and roof should be of fire resistive materials.

(9) Materials used, basic design, and structural features should be determined upon the recommendation of an architect.

(10) Construction must conform to State Fire Marshal's Regulations governing the handling, storing and transportation of flammable liquids.

111.31 Access Doors. A standard 2′-8″ x 6′-8″ door should be provided for the repair stall and possibly for the bus storage area so individuals may enter or leave the garage without opening the large overhead doors.

111.4 Other Features

111.41 Heating. An approved forced warm air furnace unit with automatic control of firing and operation is suggested. It is suggested also that the heating system should be designed to provide a minimum temperature of 45° F. for storage stalls and 60° F. or more for repair stalls.

111.42 Ventilation. Provision must be made for venting exhaust fumes from motors operated in repair stalls. See Sections 134.8 and 256.6, "Garages."

111.43 Plumbing. Wash stalls should be fitted with hot and cold water outlets and hose bibs. At least one floor drain should be furnished for each repair stall. Floor drain lines from repair stalls should pass through a grease trap and in wash stalls through a dirt trap. When buses are operated over gravel roads it may be advisable to pitch floor to rear into a gutter drain.

111.44 Lighting and Wiring. Liberal allowance must be made for both natural and artificial lighting of repair stalls. Artificial lighting should be provided for the entire structure. Yard lights mounted on the building may be needed. A minimum of one double convenient electrical outlet should be provided for each stall.

Provisions may want to be made for electric heaters. Outlets for work bench should be spaced at 4′ intervals. If welders are to be used, provision should be made for appropriate electric current supply. A sub-meter for the purpose of computing current consumption for bus garages is recommended. All wiring must be done by licensed electricians and according to the National Electrical Code.

Note: Each bus garage will constitute a separate planning problem. The suggestions in this section are not intended to be complete.

111.5 Submission of Plans. All plans and specifications of bus garages must be submitted in duplicate to the Building Section, State Department of Education, 404 Centennial Office Building, St. Paul, Minnesota 55101.

112-119 Reserved for future use.

PART III

SAFETY, HEALTH AND ENGINEERING IN CONSTRUCTING SCHOOL BUILDINGS

SECTIONS 120-149. FIRE AND LIFE SAFETY

Section

120.0 GENERAL. Sections 120-149 are statements of current, operating standards for the inspection of school buildings enforced by the State Fire Marshal

121.0 TYPES OF CONSTRUCTION. The following types of construction as described in NFPA No. 220, "Standard Types of Building Construction," 1965, published by the National Fire Protection Association: 60 Batterymarch Street, Boston 10, Massachusetts, are the reference for types of construction referred to in these sections:

Fire-Resistive Construction—Type A.
Fire Resistive Construction—Type B.
Protected Noncombustible Construction.
Unprotected Noncombustible Construction.
Heavy Timber Construction.
Wood Frame Construction.

122.0 RESTRICTIONS ON TYPES OF CONSTRUCTION

122.1 It is recommended that all school buildings be of fire-resistive construction. However, one story buildings may be other than fire-resistive construction provided exit facilities comply with Section 22, Building Exits Code (NFPA No. 101, 1965) and boiler and furnace rooms comply with Section 123.0 following.

122.2 School buildings over one story shall be type "A" or "B" fire-resistive construction without dimensional limitations.

122.3 In figuring the number of stories, a basement with the ceiling 7½ feet above the grade level next to the building at any point is to be considered at first story level.

122.4 All basement framing, walls, partitions and ceiling shall be fire-resistive construction.

123.0 ROOMS FOR HEATING PLANTS

123.1 LOCATION. Boiler and furnace rooms should be separate units or constructed as an appendage to the building. They should not be located under any part of a school building.

123.2 CONSTRUCTION. All space for heating plants, including fuel storage rooms, shall be completely enclosed by fire-resistive enclosures (two-hour rating) with self-closing "B" label fire doors (two-hour rating) protecting all openings thereto from the rest of main part of the building, except those in exterior walls. There shall be an exit door to the outside from the room containing the heating plant.

123.21 **Ships Ladders.** If the use of a ladder is necessary for egress from the boiler room to another location, i.e., to a mechanical equipment room, a ships ladder should be provided meeting minimum requirements of the Industrial Commission of Minnesota: "⅛ pitch; 4″ channel irons; 4″ treads; pipe handrail both sides; openings swing out; openings 32″ wide, 48″ high; 24″ ladder width, maximum."

123.22 **Construction Under Building.** If a boiler room or furnace room is located under any area of a school building, it shall be separated by not less than three hour fire-resistive construction with "A" label (three hour) doors. If the ceiling of the boiler or furnace room forms the floor of any pupil occupied space, explosion resistant construction, such as reinforced concrete shall be provided for the ceiling and thin glass or other approved vents provided in an exterior wall to the outer air. See NFPA No. 68, Guide for Explosion Venting.

123.3 FUEL-OIL OR GAS BURNER INSTALLATIONS. All installations should comply with standards set up by the National Fire Protection Association, Boston 10, Massachusetts.

124.0 STAIRWAYS

124.1 NUMBER OF STAIRWAYS

124.11 There shall be provided from every floor, including basement, at least two stairways (or exits) remote from each other and accessible from the corridor door of every room used by pupils.

124.12 Two stairways with a common end or intermediate landing shall be considered a single stairway.

124.2 LOCATION OF STAIRWAYS

124.21 Stairs shall be provided in sufficient numbers and in such locations as to insure convenient, well-distributed and uncongested circulation.

124.22 At least one exit shall be within 100 feet, measured along the line of travel, of the corridor door to every room used by pupils.

124.23 Distance to an exit shall be measured along the natural path of travel:

a. To a door opening directly to the street or open air,
b. To a door to an enclosed stairway, or
c. To a door in a fire wall or otherwise giving access to a place of safety.

124.24 In situations where open stairways are permitted, as a path of travel to required exits, the distance shall include the travel on the stairway, and the travel from the end of the stairway to reach an outside door or other exit, in addition to the distance to reach the stairway.

124.25 Stairs shall be located with respect to corridors, passageways, and rooms so that there will be no dead end cor-

Section

ridors requiring more than 20 feet travel from a classroom door to a stairway or exit.

124.26 All exit stairways should be located adjoining outside walls and be at the lowest or grade floor at the end of the stair run, not more than 20 feet from an outside exit.

124.3 Width

124.31 The unit of stairway width to be used as a measure of exit capacity is 22 inches, rough wall to rough wall. Fractions of a unit should not be included except that an allowance of one-half unit may be made for 12 inches of stair width added to two 22-inch units of stair width.

124.32 No required exit stair shall be less than 44 inches wide, rough wall to rough wall.

124.33 One unit of stairway width, 22 inches, should be provided for each 60 pupils or major fraction thereof on floors above or below the first.

124.34 Any given stairway may be used as a required exit from all the floors it serves, sized by the largest number of units on any floor above or below the first. If, for example, the second story requires 6 units and the third story 4 units, the total number of units necessary is 6, not 10.

124.35 Flights of stairs shall be of a constant width throughout their length.

124.36 Where the number of pupils on a floor cannot readily be determined, figure one pupil per forty square feet of gross floor area.

124.4 Treads and Risers

124.41 All stairways for pupil use in all schools shall have risers that do not exceed 7 inches in height. Treads shall not be less than 10½ inches for secondary schools, exclusive of nosings. Nosings should not be greater than 1½ inches. Treads and risers should be uniform from floor to floor.

124.42 No arrangement of treads known as winders should be permitted in any stair for pupil use.

124.43 All treads to stairways should be equipped with non-slip nosings or contain abrasive aggregates.

124.5 Stair Runs and Landings

124.51 All exit stairways shall be constructed in straight flights with not more than 16 risers in one flight. Consider ramping if less than 3 risers in a flight.

124.52 The width of landings affording changes in directions shall not be less than the width of the stairways they serve. Intermediate landings on straight run stairs shall have a dimension of not less than 44 inches measured in the direction of the run.

124.53 Where open stairways occur at right angles to the corridor, the first riser of ascending or descending stairs shall not be less than 18 inches from the face of the corridor wall.

124.54 Doors giving access to stairways shall swing in the direction of exit travel. Doors during their swing should not block stairs or landings, and in no case in new buildings should any door in any part of its swing reduce the effective width of stair landing to less than 20 inches, nor when open interfere with the full use of the stair.

124.6 Handrails

124.61 All stairways with three or more risers shall have handrails.

124.62 Handrails should not project into stairway more than 3½ inches.

124.63 Intermediate handrails should be provided as follows:

a. Four and five unit stairs should be provided with a center handrail.

b. Stairs wider than five units shall be provided with intermediate handrails at intervals of two to two and one-half units.

124.7 Construction. All required stairs for pupil use shall be built of non-combustible materials throughout, except handrails, and their enclosing walls shall be of fire-resistant construction.

124.8 Enclosures. All stairways that serve three or more stories shall be enclosed with two hour fire rating with exits directly to the outdoors. Interior doors to enclosure shall be "C" label fire doors and frame assemblies, except doors from classroom floors, storage and tunnel areas shall have "B" label fire doors and frame assemblies.

124.81 In situations where open stairways are permitted, they shall only be permitted between classroom floors. Stairways serving storage and tunnel areas shall be separate stairways with a two hour fire rating and "B" label doors and frame assemblies.

124.9 Stairway Lighting. Stairways shall be lighted to a minimum of 15 maintained foot candles intensity.

124.100 Ramps. Ramps should have non-slip surfaces and should not have a rise of more than one foot in ten. A gradient of one foot in twelve is preferred if possible.

124.200 Live Loads. Stairs shall be designed to sustain with safety a live load of 100 pounds per square foot or a concentrated load of 300 pounds so located as to produce maximum stress conditions.

125.0 BUILDING EXITS

125.1 Number

125.11 There should be at least two means of egress, remote from each other from every floor of a school building. Doors from classrooms and other student occupied rooms shall enter the corridors between exits or there shall be direct egress to the outside from the rooms.

125.12 Exits should be provided to serve the total requirements of (a) floors above the first, (b) the basement, (c) the first or main floor, (d) the auditorium, gymnasium, or other places of assembly.

Section

125.2 Location

125.21 At least one exit or enclosed stairway shall be within 100 feet, measured along the line of travel, of the corridor door of every room used by pupils.

125.22 Where schools are located on busy highways or streets, exits shall be so located as to minimize the danger to departing pupils from vehicular traffic.

125.23 The following places of assembly, when possible, shall be provided with exit doors distinctly separate from general school exits: (a) auditorium units, (b) gymnasium units, and (c) multi-purpose rooms.

125.3 Width and Number of units of Exit Door Width, Street Floor Exits

125.31 A unit of exit door width shall be 22 inches. Door jambs shall not project into the required width of doorways by more than 2 inches for each 22 inch unit (20 inches net opening). No exit from a corridor to a stair, a corridor to outdoors shall provide less than two units in total opening widths. Fractional units of exit door width may not be counted except that one-half unit may be counted for 12 inches of exit door width in excess of one or more units.

125.32 No door or door opening which leads from a room of instruction to a corridor or to the outdoors shall be less than 36 inches wide.

125.33 The minimum number of units of exit door width from the first or entrance story shall be as follows:

125.331 One unit of exit door width for each required unit of stairway width above and below the first floor. (The basement to be treated the same as stories above the first floor). See Section 124.33.

125.332 One additional unit of door width for each 100 persons or major fraction thereof occupying the first floor, other than places of assembly.

125.333 Where places of assembly are designed or planned to be used or occupied simultaneously by the schools and the general public, additional exits shall be provided to comply with Section 125.9 "Exits from Places of Assembly."

125.334 Where places of assembly are designed or planned to be used solely for school purposes and it is the intentions that Section 125.333 above shall not apply, a written statement to that effect should be furnished to the Commissioner of Education and the State Fire Marshal by the school board of the district at the time that building plans are submitted.

125.335 A schedule of the exits and exit capacities shall be shown on the plans. The schedule shall include the total capacity of the building, each floor, each place of assembly, stairways, and outside exit doors.

125.4 Swing. Doors shall swing in the direction of exit travel.

125.5 Hardware

125.51 All doors used for general exit purposes which are to be locked, including exit doors from places of assembly having a capacity in excess of 100 persons, should be provided with panic devices or other locking and unlocking devices approved by the Fire Marshal that open when a fifteen pound pressure is applied to the bar. Such doors should be locked and unlocked by keys only. Flash bolts are prohibited. These doors should be provided with checks, stops and closers.

125.52 Classroom and other instructional area doors which are to be locked shall be equipped with "Schoolhouse" type locksets that can be operated by key only, and cannot be locked against egress from within.

125.53 Inside doors to pupil's toilet rooms should be provided with door closers and push and pull plates. Where a door, toilet to exterior is provided, locking hardware which cannot be locked against egress may be used.

125.6 Exit Vestibules

125.61 Vestibule or storm doors at any particular exit shall have the same swing and a capacity at least equal to that of the regular exit door at that place. Such doors shall be free acting outward or be equipped with panic exit hardware.

125.62 Vestibules shall not be put to uses reducing traffic capacity.

125.7 Exterior Stairways. No exterior stairway should serve as an exitway, but service stairways will be permitted to serve one floor. Treads should be not less than 10 inches and risers not more than 7½ inches. Intermediate handrails should be provided as for interior stairways.

125.8 Outside Steps

125.81 Outside steps are highly objectionable and should be reduced to a minimum number compatible with good construction and site conditions.

125.82 At least one of the entrances to a school building should be at grade to permit easy access by physically handicapped or wheel chair pupils.

125.9 Exits from Places of Assembly

125.91 Exits shall be provided for the maximum designed capacity of places of assembly.

125.92 One unit of exit door width shall be provided for each 100 persons or major fraction thereof.

125.93 Every room, balcony*, or other space having a capacity of 100 or more persons shall be provided with at least two exitways; 600 or more, with at least three exitways; 1,000 or more with at least four exitways. Doorways shall be located a reasonable distance apart and so that the exitways from the floors are readily and easily accessible therefrom.

125.931 Number of Occupants. Where the number of occupants is undetermined, the number of occupants of auditoriums, gymnasiums, or other places that may be used for assembly purposes shall be assumed to be one person per 6½ square feet of net floor area; of libraries and shop areas, one person per 30 square feet of net floor area; and of the dining area of lunchrooms, one person per 10 square feet of net floor area. (Net floor area means the area inside the enclosing walls of the auditorium, gymnasium, or other place of assembly, including aisles).

---

*Any balcony shall be provided with at least two exitways.

125.94 Exit Illumination and Signs

125.941 Electrically illuminated exit lights clearly indicating the direction of egress to the exterior of the building, shall be provided over all exit doors from auditoriums, gymnasiums, combined auditorium-gymnasiums, multiple-purpose rooms, lunchrooms, other rooms accommodating 100 or more persons, and over all exit doors from the building.

125.942 Exitways shall be illuminated at all points such as angles, intersections of corridors and passageways, stairways, landings of stairs and exit doorways to an intensity of not less than 5 footcandles on the illuminated surface.

125.943 Where necessary, in corridors and other passageways, an electrically illuminated sign with the word EXIT and with a suitable arrow or pointer to indicate the direction of egress shall be provided.

125.944 All exit signs should be continuously illuminated with an intensity of not less than 5 footcandles on the illuminated surface or shall be internally illuminated during the time that the conditions of occupancy require that the exitways be open or available. The word EXIT shall not be less than 4½ inches for internally illuminated signs and should be 6 inches high for externally illuminated signs.

125.945 All exit lighting circuits should be installed in metal conduit and be on a separate circuit ahead of the main entrance service panel or to comply with Article No. 700 of the National Electric Code. However, it will be acceptable, whenever feasible and possible as far as locations permit, to encase the circuits for the fire alarm system and for the exit lights in the same conduit or raceway providing each of the circuits have the same voltage and the conductors have insulation of the same dielectric strength or value.

125.946 All control switches shall be installed so as to be under the supervision of authorized persons.

126.0 CORRIDORS

126.1 CONSTRUCTION. In buildings of two stories or higher, the corridor shall be of fire-resistive construction in walls, floors, and ceilings.

126.2 WIDTH. The minimum clear width of corridors for elementary and secondary schools should not be less than the following:

126.21 Elementary schools with single-loaded corridors:

a. No lockers or other clothes storage	7 feet
b. Lockers or clothes storage on one side	8 feet
c. Lockers or clothes storage on both sides	9 feet

126.22 Elementary schools with double-loaded corridors:

a. No lockers or other clothes storage	8 feet
b. Lockers or clothes storage on one side	9 feet
c. Lockers or clothes storage on both sides	10 feet

126.23 Secondary schools with single-loaded corridors:

a. No lockers or other clothes storage	8 feet
b. Lockers or clothes storage on one side	10 feet
c. Lockers or clothes storage on both sides	12 feet

126.24 Secondary schools with double-loaded corridors:

a. No lockers or clothes storage	9 feet
b. Lockers or clothes storage on one side	10 feet
c. Lockers or clothes storage on both sides	12 feet

126.25 Where lockers occur in sections 126.21–126.24 above, the minimum clear width of corridors means width measured from face of lockers.

126.26 The width of passageways, other than corridors, should be determined by their use, but the minimum clear width of such passageways should be not less than 5 feet.

126.3 LIGHT. All corridors shall be provided with lighting fixtures. The minimum maintained lighting intensity shall be 15 foot candles.

126.4 PROJECTIONS AND OBSTRUCTIONS. Wall projections, such as drinking fountains, radiators, wall-hung fire extinguishers, open classroom doors (at the end of their swing), and pilasters should extend not more than 8 inches out from the face of the corridor walls. Wherever possible all equipment should be flush-mounted.

126.5 TERMINATION. Each corridor on the first floor shall terminate with a direct exit to the exterior of the building.

126.6 CEILINGS

Running of trunklines of pipes and ducts exposed in corridors or passageways used by pupils should be avoided.

127.0 INTERIOR FINISH (Ratings refer to flame spread ratings)

127.1 Interior finish in interior corridors, exitways, and in assembly rooms of over 100 capacity shall have Class A flame spread rating, exclusive of millwork. See NFPA No. 101, Building Exits Code, Section 44 and also Section 127.3 following.

127.11 Ceiling or wall acoustical tile shall be fire-resistive Class A—mineralite or equal.

127.2 Interior finish may be of Class C elsewhere than is specified in Section 127.1 provided, however, that in any location the exposed portions of structural members complying with the requirements for heavy timber construction may be permitted. Laminated wood shall not delaminate under the influence of heat.

127.3 The alphabetical classification of finish materials used is based upon average flame spread and combustibility and shall be in accordance with the National Fire Protection

Section

Association designation of the American Society for Testing Materials, ASTM E-84: "A" having a flame spread of 0–25, "B" having a flame spread of 25–75, and "C" having a flame spread of 75–200, or under Federal Specifications SS-A11b.

128.0 INTERIOR DOORS

128.1 Width

128.11 Doors from school rooms to corridors shall be not less than 36 inches wide.

128.12 Doors from classrooms to auxiliary rooms may be not less than 30 inches wide.

128.2 Swing

128.21 Doors of rooms with a capacity of 50 or more persons shall in all cases swing outward into or toward the corridor, or directly to the outdoors.

128.22 Doors when standing open at the end of their swing should project no more than 8 inches into the corridor.

128.23 Classroom doors which swing into a corridor should be hung to swing in the direction of corridor traffic toward the nearest exit so that panic traffic will tend to open rather than close the doors.

128.24 Double swinging doors for pupil use are not recommended.

128.3 Number. Single purpose chemistry laboratories designed to accommodate twenty or more pupils should have two means of egress.

128.4 Glazing. Fire doors, if glazed, should be glazed with clear wire-glass.

128.5 Hardware. See Section 125.5.

128.6 Fire Doors

128.61 Fire doors approved by the National Board of Fire Underwriters shall be provided in interior doorways to the following spaces:

a. Class A doors—firewalls, transformer vaults, where required by the National Electric Code.

b. Class B doors—head or foot of basement stairs; boiler, furnace, heater and fuel rooms; mechanical equipment rooms; vertical shaftways other than required stairway enclosures; combustible storage rooms; and shops or shop areas.

c. Class C doors—stairway enclosure up two or three stories.

128.62 All fire doors except to transformer vault, which should be kept locked shall have self-closing devices, and any hold-open closers shall have fusible link releases.

128.63 Openings in fire walls shall be equipped with standard fire doors in conformity with the current code of the National Board of Fire Underwriters.

Section

129.0 SEATING AND AISLES IN PLACES OF ASSEMBLY

129.1 General Requirements

129.11 Seating arrangements and aisles in auditoriums and all rooms and spaces used for assembly with a capacity of 200 or more persons shall comply with the requirements of the Buildings Exit Code NFPA #101, local codes and this guide.

129.12 Grandstands and bleachers, indoors and outdoors, and other places of outdoor assembly shall comply with the requirements of NFPA #102 and Chapter 1 of NFPA #101, local codes and this Guide.

129.2 Foldable Bleachers. All foldable bleachers shall conform to the most recent standards as set forth by the American Standards Association (ASA Z20.3) and this Guide.

129.21 Foldable bleachers, telescope and folding, within school buildings, having as many as 20 rows of seats, will be approved; however, 18 rows of seats is considered a more practicable maximum.

129.22 All foldable bleachers should be provided with vertical simulated center aisles at least 30" wide, spaced not more than two standard 16 foot sections of 22 seats apart, allowing 16 inches per seat; and each exposed or wall end of the bleacher section should be provided with vertical simulated aisles at least 24 inches wide.

Note: The term "simulated" as here used refers to the identification of an aisle through the use of non-skid material, paint or other suitable substances upon the seat surface, which is sufficiently different in color and texture to set it off as an aisle or an area where people move upward or downward.

129.23 Foldable bleachers having 12 or more rows of seats shall be provided with:

a. Vertical simulated center aisles at least 36 inches wide and spaced not more than two standard 16 foot sections or 22 seats apart; and

b. Hand rails running vertically, and located in the middle of these center aisles.

129.24 In large bleacher sections having 12 or more rows, and when it is deemed desirable, center hand rails may not be continuous but may have a mid-point break equal to one row of seats for cross over purposes.

129.25 Foldable bleachers, 4 or more rows high, where the outside or extreme ends of the entire bleacher section do not terminate against a wall but are open and exposed, shall be provided with hand rails.

129.3 Portable Bleachers. Portable bleachers, including folding and telescopic types having more than 12 rows of seats, will not be approved.

129.31 All portable bleachers must have simulated aisles and hand rails as outlined in 129.23 above, also guard or hand rails along the back.

Section

130.0 FIRE ALARM SYSTEMS

130.1 **Basic Provisions.** In general, the School Building Fire Alarm System shall be as follows:

130.11 A completely supervised type.

130.12 Shall have sounding stations on 100-foot to 150-foot spacing: (a) in corridors, (b) in areas of high noise levels, such as band room, shops, boiler room, etc., and (c) a weatherproof station on exterior of the building facing area with residences.

130.13 Shall have automatic sending stations in boiler room, kitchen, janitor's closets, storerooms, etc., namely critical areas.

130.14 Shall have manual sending stations adjacent to all points of egress from each floor and from the building.

130.2 **Application to Existing and New Buildings or Additions.** In order to clarify existing standards of the State Fire Marshal's Office for the State of Minnesota for fire alarm systems for school buildings, the following provisions shall be complied with:

130.21 Existing Building

a. If a new fire alarm system is being installed, it must comply with the standards of the Fire Marshal's Office with the system and stations of type and location as outlined in the Basic Provisions above.

b. If an existing system in an existing building is being rewired and/or added to, the completed system shall comply with the Basic Provisions above.

130.22 New Building. The system shall comply with the Basic Provisions above.

130.23 New Addition to Existing Building

a. If the existing building does not comply with the Basic Provisions above, a complete new system shall be installed in both the existing building and the new addition(s). The new system shall be a single system and shall comply with the Basic Provisions above.

b. If the existing system is of the supervisory type and complies in all ways with the Basic Provisions above, the existing system may be extended into the new addition, making one system complying with the Basic Provisions above.

Note: Care should be taken to assure that the control unit has capacity for the added stations.

c. If the existing system is of the supervisory type, but does not comply with the Basic Provisions above as to location of sending and sounding stations, the system may be extended as per 130.23 b. above, but the system in the existing building shall be remodeled so that the complete system in both the existing building and the new addition shall comply with the Basic Provisions above.

130.24 Uniform Sounding Device. The sounding device in both the new building, or addition to the old building, and the existing building shall be uniform in volume and tone.

Section

131.0 FIRE FIGHTING EQUIPMENT

131.1 Fire extinguishers must be installed in all school buildings. They should be of the following type, capacity and locations:

131.11 In fire-resistive buildings, one 2½ gallon Class "A" fire extinguisher for each 5,000 square feet of those areas used for other than shop or storage purposes; in buildings of other than fire-resistive construction, and in all shops and storage areas of buildings of any type of construction one 2½ gallon Class "A" fire extinguisher for each 2,500 square feet of floor area.

131.12 Class "A" fire extinguishers may be of the following types:

(1) soda acid
(2) water (stored carbon dioxide pressure cartridge)
(3) anti-freeze solution (stored pressure cartridge and internally generated pressure)
(4) foam
(5) loaded stream

131.13 Provide not less than one 5 pound carbon dioxide fire extinguisher or one 5 pound dry powder extinguisher in kitchens, agriculture laboratories, chemical laboratories, home economics cooking laboratories, stages with electrical switchboards and mechanical equipment rooms.

131.14 Provide not less than one 10 pound or two 5 pound dry powder or one 2½ gallon foam fire extinguishers in all shops and furnace rooms.

131.15 Provide not less than one 15 pound dry powder or one 2½ gallon foam fire extinguisher in all boiler rooms and not less than one 10 pound dry powder fire extinguisher for all transformer vaults.

131.16 Provide one wool or asbestos fire blanket in each chemistry laboratory, kitchen, and home economics cooking laboratory, installed in a metal cabinet identified with the words "FIRE BLANKET."

131.2 All extinguishers shall be so located that a person will not have to travel more than 100 feet to reach the nearest fire extinguisher, and not more than 50 feet in shop areas.

131.3 Fire extinguishers shall be installed so that the top of the extinguisher is not more than 5 feet above the floor.

131.4 Corridor extinguishers shall be recessed or installed in a recessed cabinet.

131.5 All extinguishers shall be properly inspected and maintained. An extinguisher should be recharged immediately after being used. All extinguishers, especially the soda acid and foam type, should be emptied and recharged once a year to prevent deterioration. Carbon dioxide fire extinguishers, including the cartridge of the dry powder type, loaded stream, and water and anti-freeze solution stored pressure cartridge types, should be weighed at least once each year to detect loss by leakage. Any which show a loss of ten percent or more of the rated capacity stamped upon it, should be recharged.

Section

131.6 All fire extinguishers of the following types: soda-acid, water and anti-freeze solution cartridge operated types, foam and loaded stream types, which have been in service, should every five years be subjected to a hydrostatic pressure test to determine if they are still capable of safely withstanding the pressure which might be generated during their operation. The test should be made in accordance with Section 71 of the National Board of Fire Underwriters' Standards, No. 10, "First Aid Fire Appliances."

131.7 Standpipe and hose should be installed in buildings of more than three stories in height, in accordance with National Board of Fire Underwriters, "NATIONAL BUILDING CODE," Section 809 if it is possible to supply an adequate water supply and pressure.

131.8 School buildings in areas serviced and protected by local fire departments should be provided with standard fire hydrants accessible to the property.

131.9 Sprinkler protection should be installed at the top of all trash or rubbish chutes and in all incinerator rooms.

132.0 GAS TRANSMISSION AND BUILDING SERVICE LINES

132.1 Every school building should be located at least 1,000 feet from any high pressure gas mains (mains with pressure in excess of 400 psi).

132.2 An outside gas shut-off valve, accessible, and plainly marked "MAIN GAS VALVE" should be installed on the building gas service main, preferably more than five feet from the building.

132.3 Main gas supply lines should not be placed under the building or in trenches or non-ventilated spaces, such as suspended ceilings, unless properly cased and vented to the outside. Branch supply lines should not be installed in enclosed spaces.

132.4 Where gas outlets are provided in laboratories, shops, and kitchens, a master control valve, quick closing and easily accessible should be provided in each area where there are two or more outlets.

132.5 All gas service lines shall be welded pipe except at shut-offs and applicance connections when L.P. systems.

133.0 INCINERATORS OR DESTRUCTORS

133.1 Incinerators or destructors in school buildings should be located and installed to comply with the current standards of the National Board of Fire Underwriters for Incinerators, NBFU Pamphlet No. 82.

133.2 Top charging incinerators or destructors should not be used in school buildings without prior approval on specific installations.

133.3 Incinerators or destructors designed with side charging doors at platform or floor levels should have charging openings no larger than 24 inches in height and 30 inches in length equipped with self closing hand or foot operated doors.

Section

133.4 Rooms in which incinerators or destructors are located should be kept locked. The doors of these rooms should be equipped with latches that can only be opened with a key from the inside.

133.5 Provision shall be made to provide combustion air. See NBFU No. 82 for standard.

134.0 HAZARDOUS AREAS: SHOPS, LABORATORIES, GARAGES

134.1 Industrial arts and vocational shops, in general, should not be located beneath any other area of a school building.

134.2 Automotive, power mechanics, and agriculture shops, or any other shops where gasoline or other flammable liquids may be used or involved shall not be located beneath any area of a school building.

134.3 When any automotive, power mechanics, agriculture shops, or any other shops where gasoline or other flammable liquids may be used or involved are located in single story structures, such structures shall have one hour fire-resistive construction and be separated from any other portion of the school building by two hour fire-resistive construction and "B" labeled doors.

134.4 WELDING. If gas, spot, or electric welding equipment is located in shops where gasoline or flammable liquids may be used or involved, such equipment shall be separated from the rest of the shop by an enclosure of Type B (two hour) fire-resistive construction.

134.5 FINISHING ROOMS. Paint finishing rooms in industrial arts or vocational shops shall be Type B (two hour) fire-resistive construction.

134.6 SPRAY PAINTING BOOTHS. Any finishing room in which spray painting is done, including tractor or machine spraying, shall be equipped with a spray booth conforming to the standards of the Minnesota Industrial Commission as outlined in "Minnesota Regulations Relating to Industrial Safety," 1958, and any subsequent amendment thereto.

134.7 KILNS. No kiln or similar heat producing device in any shop, laboratory or any room shall be located less than 20 feet from any spray painting device or area where spraying may be done.

134.8 GARAGES OR BUILDINGS HOUSING OR SERVICING MOTORIZED EQUIPMENT. Any building used for the purpose of housing and Servicing of motorized equipment shall conform to State of Minnesota: "Rules and Regulations of the State Fire Marshal Governing the Handling, Storage and Transportation of Flammable Liquids."

134.81 Service Pits. (612-03 "Rules and Regulations of the State Fire Marshal Governing the Handling, Storage and Transportation of Flammable liquids.")

"612-03-3 In an establishment where greasing or other services are to be regularly rendered to vehicles of such type, size or weight or for other good reason it would be impracticable to utilize ramp or hoist type equipment for these

Section

services, a pit may be installed but only after written approval from the State Fire Marshal upon application in writing accompanied by plans and specifications for the proposed installation. Every such approval shall be on the condition that the proposed installation be constructed and maintained in conformity with the following requirements:

"(1) Each pit must be constructed of poured concrete.

"(2) All electric wiring and electric equipment in each pit or used in connection therewith must be explosion proof and all such equipment shall bear the Underwriters Laboratories label.

"(3) Each pit must be equipped with a mechanical exhaust system capable of exhausting five cubic feet of air per minute per square foot of floor area within the pit and shall have a capacity of not less than 1400 cubic feet per minute. The exhaust system shall be wired electrically so that the system will be in full operation when the pit lights are lighted.

"(4) The discharge from the exhaust system shall be to the outside atmosphere and located in such a manner that the exhaust air will not re-enter the building.

"(5) No sewer connection shall be permitted from any pit, unless protected with an approved grease trap which will effectively intercept greases and oils, and prevent their entry into the sewer.

"(6) Any pit capable of servicing more than one vehicle at the same time shall be provided with two exits."

135.0 MISCELLANEOUS FIRE PROTECTIVE FEATURES

135.1 Curtains, draperies, decorative hangings and similar materials shall be noncombustible or flameproofed in corridors, exitways, stages, and assembly occupancies.

135.2 All oils, paints and other flammable supplies and wastes shall be stored in fireproof containers and storage rooms.

Section

135.3 Heating units, such as gas plates and gas burners shall be insulated from table tops or other combustible materials.

135.4 Steam pipes through combustible materials or walls and all smoke pipes and breechings should have ample clearance or fire-resistive protection.

135.5 Smoke stacks, if extending 25 feet or more above the building, should be grounded for lightening protection. Chimneys, flues, and all connections to them should be tight. Neither chimneys nor flues should be used as supports for structural members.

136.0 ELEVATORS IN SCHOOL BUILDINGS. All work, equipment, materials, devices and processes involved in the installation of elevators in school buildings shall comply with the applicable requirements of the latest editions and/or supplements of the following codes:

American Standard Safety Code for Elevators, Dumbwaiters and Escalators.
Minnesota Safety Code for Elevators, Dumbwaiters, Escalators and Manlifts.
National Building Code.
National Fire Protective Association Building Exits Code.
National Board of Fire Underwriters.
National Electric Code.

137.0 SCHOOL BUILDINGS, USABLE BY PHYSICALLY HANDICAPPED. School building facilities should be so planned and constructed as to be accessible to and usable by physically handicapped students. In accordance with Laws 1965 Chapter 243, the minimum specifications to be used by the Fire Marshal for review of school building plans and specifications and making recommendations are those set forth in the "American Standard Specifications for Making Buildings and Facilities Accessible To and Usable by the Physically Handicapped," approved by the American Standards Association, Inc., on October 1, 1961.

138-149 Reserved for future use.

SECTIONS 150-169. STRUCTURAL DESIGN

Section

150.0 RESPONSIBILITY. The responsibility for designing a building that is structurally sound is a part of the service of the registered professional engineer and architect. The State Board of Education does not assume this responsibility. As a basis for approval of structural plans, the Board will require evidence of what is commonly accepted as good practice in the field of structural design as stated in the following sections.

150.1 Recommendation. The person preparing the structural plans, or in direct supervision of the structural plans, for all new schoolhouses, additions, or major alterations should be a "Registered Professional Engineer" duly qualified by registration as required by M.S. 1945 Section 326.02, as amended. Such engineer should be experienced in the structural design of school buildings.

151.0 POLICY STATEMENT: Local Codes Requiring Local Approval of School District Plans and Specifications for New Schoolhouse Construction or for Schoolhouse Rehabilitation.

The State Board of Education recognizes the legal status of local building codes, and that it is reasonable that all connections to sewer, water, gas, and electric services be governed by local codes and inspections made by local authorities at the time the connections are made, provided there are no state codes that are more restrictive.

But, since in respect to Schoolhouse Construction, Minnesota Statutes require:

(1) that school building be designed by professional architects and engineers; and

(2) that school building plans of every Minnesota School District, both for new construction or for building rehabilitation, be approved by the Commissioner of Education under regulations of the State Board of Education,

it is deemed unnecessary, after such approval, that any municipal agency which has adopted by local ordinance a code termed a "uniform building code" require, as a section or sections of such code, reapproval of local school district building plans and specifications by local examiners, or outside examiners, often at considerable cost and delay in time.

152.0 STRUCTURAL DESIGN STANDARDS. The overall structural design of new schoolhouse construction and schoolhouse rehabilitation is to conform to the current issue of such codes of nationally recognized good practice, where applicable, as the following:*

152.1 "Building Code Requirements for Reinforced Concrete." (ACI) American Standards Association.

152.2 "Design Handbook." Concrete Reinforcing Institute.

152.3 "Design Manual of Welded Wire Fabric for Building Construction." Wire Reinforcement Institute, Inc.

Section

152.4 "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings." American Institute of Steel Construction.

152.5 "American Standard Building Code Requirements for Masonry." American Standards Association.

152.6 "Standard Specifications for Open Web Steel Joist Construction, Short Span Series." Steel Joist Institute.

152.7 "Standard Specifications for Open Web Steel Joist Construction, Long Span Series." Steel Joist Institute.

152.8 "Specifications for the Design of Light Gauge Cold Formed Steel Structural Members." American Iron and Steel Institute.

152.9 "National Design Specifications for Stress-Grade Lumber and its Fastenings," National Lumber Manufacturers Association, Washington, D.C.

152.10 "Timber Construction Standards." American Institute of Timber Construction.

152.11 "Standard Specifications for the Design and Fabrication of Structural Glued Laminated Lumber." West Coast Lumberman's Association and Southern Pine Association.

152.12 "Standard Code for Arc and Gas Welding in Building Construction." American Welding Society.

152.13 "American Standard Building Code Requirements for Excavation and Foundations." American Standards Association.

152.14 "Building Code Requirements for Reinforced Masonry." National Bureau of Standards.

---

*Standards and Practices Representing Recognized Good Practice, National Building Code, Current Edition.

153.0 SOIL BORINGS

All plans are to contain a log of soil borings or other substantial data showing the pertinent foundation sub-surface conditions. The log of borings or the plans should contain a statement stating the bearing value of the soil and the bearing value used for designs of footings and foundations. Soil borings are recommended before final purchase of property.

154.0 DESIGN LOADS

154.1 Minimum Design Loads. School buildings and their accompanying structures should be designed for all conditions of loading as specified in the American Standard Building Requirements, "Minimum Design Loads in Buildings and Other Structures," approved by the American Standards Association and sponsored by the National Bureau of Standards unless specifically modified herein. In addition to all live loads, the structure should be designed for the dead weight of partitions, walls, floor and other appurtenances.

154.11 The following uniformly distributed live loads should be assumed for the purpose of design except when local codes are more restrictive:

Occupancy or Use	Live Loads Lbs. Per Sq. Ft.
Auditoriums and Assembly Halls, Including Balconies	
Fixed Seats	80
Movable Seats	100
Boiler Rooms	100*
Cafeterias (Major Units)	100
Kitchens (Major Units)	100*
Classrooms	50
Corridors	100
Drafting rooms	50
Dressing rooms	50
Gymnasiums	100
Heating rooms	100
Laboratories (Major Units)	80
Landings	100
Libraries	
Stack rooms should be computed at not less than 30 lbs. per cubic foot or	150
Reading rooms	60
Locker rooms	50
Lunchrooms	100
Mechanical equipment rooms	100*
Multipurpose rooms	100
Music rooms (Major Units)	100
Office Administration Space	50
Playrooms	60
Practice rooms	100
Stairs and Fire Escapes	100
Shops—Light operation	125
Heavy operation	125–200**
Stage Floor	150
Stairways	100
Storerooms	100
Toilets, general	60
Toilets, private	50

Note: Only major areas are included above. Spaces not listed are to be designed for live loads listed for similar occupancy. It is assumed that live floor loadings for any area will be increased or modified on the basis of usage and essential equipment by registered professional structural engineer or architect and that adequate safety to occupants will be an imperative consideration.

See Section 154.6 following, concerning justifiable deviations from assumed live loads.

154.2 Grandstand and Bleachers. In grandstands and bleachers the live load for the seating areas, walks, ramps, etc., should be 100 lbs. per square foot. Each seatboard should be designed for a live load of not less than 120 lbs. per lineal foot.

154.21 All grandstands, bleachers, etc., should be designed for horizontal forces, resulting from occupancy, applied at the level of each seat. In the direction lengthwise of the seat, the force should be 24 lbs. per linear foot of each seat. In the direction crosswise of the seats, the force should be 10 lbs. per linear foot of each seat.

154.22 Grandstands, bleachers, etc., should be designed to withstand a wind force of 20 lbs. per square foot of exposed surface, acting in any direction, in addition to the occupancy loads. In the design of footings for grandstands, bleachers, etc., the maximum design live load (not to include roof areas) may be decreased 40% because of short term loading conditions.

154.3 Floor and Roof. There should not be placed, or caused or permitted to be placed, on any floor or roof of a building or other structure a load greater than that for which such floor or roof is designed.

154.31 Roofs should be designed for a uniformly distributed load, including snow loads, over the horizontal projection as described in the following schedule of loads:

Roof Slope	Uniform Load Over Horizontal Projection Lbs. Per Square Foot
Less than 20 degrees	40
From 20 to 45 degrees	30
More than 45 degrees	20

154.32 Roofs to be used for special purposes should be designed for appropriate loads as directed or approved by the State Board of Education.

154.4 Lateral Loads. All buildings, including roof structures, should be designed to withstand a wind load as outlined in 154.41 following. The structural drawings for all buildings should be accompanied by a brief statement by the professional structural engineer explaining the provisions that have been made for resisting lateral forces.

154.41 Construction should be designed to withstand a lateral force (wind) of 15 lbs. per sq. ft. for buildings up to 50 feet high and 20 lbs. per sq. ft. for buildings from 50 to 200 feet high. For roofs of over 30 degree slope, design for 20 lbs. per sq. ft. on the windward side and 10 lbs. per sq. ft. on the leeward side.

154.5 Special Loads. Provision should be made for all special loads herein described and any other special loads to which the buildings may be subjected.

154.51 **Below Grade.** All retaining walls below grade are to be designed to resist lateral soil pressure with due allowance for hydrostatic pressure and for all superimposed vertical loads.

154.52 **Hydrostatic Uplift.** All foundation slabs and footings subjected to water pressure are to be designed to resist a uniformly distributed uplift equal to the full hydrostatic pressure.

---

*Plus any additional loading needed for concentrated weight under heavy equipment.
**According to use.

Section

154.53 Construction Loads and Erection Stresses. Provision is to be made for temporary construction and wind loads which may occur during erection of the building; and all structural members and connections are to be designed and erected so as to prevent overstressing during construction.

154.6 JUSTIFIABLE DEVIATIONS. When in the judgment of the professional structural engineer or architect certain deviations from the loads as stated in the preceding sections are possible and justifiable, and in addition are clearly indicated on the appropriate drawings, such deviations may be made, provided safety to occupants and soundness of structure are assured.

155.0 DESIGN DATA. Design data as follows should be scheduled on final drawings:

a. Assumed live loads

b. Allowable working stresses used

c. Assumed wind loads.

156.0 FALLOUT SHELTERS—BLAST SHELTERS. As understanding develops for the need for school buildings to be used as fallout or blast shelters, it will be imperative that structural engineers and architects be informed of the latest factual design standards as they develop or evolve for these purposes.

Section

157.0 INSPECTION DURING CONSTRUCTION. The inspection during construction of the structural portion of all school buildings erected in the State of Minnesota should be under the direct supervision of a registered professional structural engineer and architect, or a duly authorized representative, whose responsibility should be to assure compliance with the plans and specifications of the designer. No change from the original plans and specifications should be made except with the knowledge and consent of the registered professional structural engineer responsible for the structural design.

158.0 SIGNATURE ON STRUCTURAL PLANS. The certification and signature of the person preparing the structural plans, or under whose direct supervision the structural plans were prepared shall be placed on the appropriate sheet.* A person in direct supervision of structural plans, as referred to above, is construed to mean the person whose professional skill and judgment are embodied in the document signed, and who assumes the responsibility for the accuracy and adequacy thereof.**

159-169 Reserved for future use.

---

*M. S. 1957 Section 326.12, Subd. 3.

**Rules of Minnesota State Board of Registration for Architects, Engineers, and Land Surveyors, 1956.

SECTIONS 170-189. SOUND CONTROL

Section

170.0 GENERAL. School design should include planning for auditory comfort and efficiency. Such planning should consider: (a) control of external sound; (b) control of transmitted internal sound; and (c) control of sound quality within any one room.

170.1 Background Sound Conditions. Except in broadcasting or recording the background sound conditions or noise level need not be anywhere near silence. However, it is essential to good learning that the background noise level in schools be kept as low as possible consistent with good sound quality. While acceptability is a subjective measure, the noise level in a room under which sound activities can be comfortably pursued has become fairly well defined for many activities. A table of suggested maximum acceptable background noise levels for various spaces in schools is offered in Table I, col. 6, "Tolerable Noise Levels." See 177.1.

170.2 The Acoustical Engineer. A competent architect is usually qualified in the acoustical planning of small and simple areas. The employment of an acoustical engineer is desirable for the design of larger and more complex spaces as music suites and auditoriums, or rooms serving dual functions.

171.0 EXTERNAL SOUND. Chief external noises originate from airplanes, (missile and space ship launchings), automobiles, trains and noisy industrial establishments. Other sources of external noise include playgrounds, bus loading areas, service yards, or group activity areas.

171.1 External Sound Control

a. External noise can be eliminated or alleviated by (1) proper site selections, (2) proper site planning which would locate the school away from traffic and industry, and (3) by proper internal planning which would group noisy elements of the school adjacent to noisy external areas which may be present.

b. Some reduction in the transmission of external sound can be obtained by grading and planting.

172.0 INTERNAL SOUND. The chief sources of noises within the school are music rooms, shops, cafeterias, gymnasiums, auditoriums and corridors. It is recommended that these noisy elements be isolated from quieter areas either by plan or by adequate sound barriers.

The background noise level is to be distinguished from the useful sound in each room. The useful speech, music, or other sounds in each space will produce a sound level necessarily much higher than the background noise level. The useful sound becomes undesirable (noise) under two conditions.

(1) When it is sustained too long by reflection without absorption.

(2) When it is transmitted to other groups producing their own sounds or silences.

173.0 SOUND ABSORPTION. Sound is absorbed by being converted into other forms of energy. The principal methods by which this conversion is accomplished are (a) the porosity of materials surrounding the sound, and (b) panel vibration. Almost all the standard sound control materials depend upon porosity.

173.1 Efficiency of Materials. The efficiency of a material in sound absorption at a specific frequency is given by its absorption coefficient at that frequency. This quality is the percentage of the sound energy absorption coefficients at 256, 512, 1024, and 2048 cycles.

174.0 SOUND TRANSMISSION AND CONTROL

174.1 Insulation Quality of Materials. The sound insulating quality of a material is expressed in terms of its transmission loss in units called decibels. It is recommended that sound transmission loss between adjacent rooms be not less than 40 decibels for speech rooms and not less than 45 decibels for music rooms. Transmission loss between music rooms and adjacent speech rooms should be not less than 55 decibels.

174.2 Sound Transmission by Continuous Air Path. Because one means of sound transmission is by a continuous air path, porous materials, which are excellent for sound absorption within a room, are not effective in reducing sound transmission from room to room. A high degree of sound insulation requires complete closure of cracks around windows, doors, and pipes, and insulation of ventilating ducts serving more than one room.

174.3 Sound Transmission by Diaphragmatic Action. Because other means of sound transmission is by diaphragmatic action of a partition (vibration reproducing the pattern of sound waves), it follows that the heavier and more impervious the partition, the greater the transmission loss of the partition. Thus brick is more effective than concrete block of the same thickness, and regular concrete block more effective than lightweight block. Plastering one or both sides of a masonry partition increases its effectiveness. Paint, although sealing the pores of the material, does not improve the sound insulating qualities of a wall. Paint applied to a porous partition, such as a 4" cinder block, will increase the sound transmission loss through the block. It will also, however, reduce the sound absorptive properties of the porous wall.

174.4 Compound Wall. Because the vibration characteristics of a compound wall, consisting of two or more structurally separate partitions, are discontinuous, such a wall is more effective in reducing sound transmission than a single wall of the same thickness. Such a wall is useful in exceptionally noisy areas, such as music suites.

174.5 Impact Noise or Equipment Vibration. Impact noise or machinery vibration should be suppressed at the source by use of absorptive floor or wall coverings and by insulating machinery from a structure by means of resilient mountings. In the case of ventilating fans, duct connections should be broken by a flexible connection, preferably fireproof. Provision should be made for separation of toilet exhaust ventilation for each sex to prohibit the possibility of noise carrying through ducts. Shop dust or wood waste collecting systems are particularly noisy and require special treatment. It is strongly recommended that the collection units be located outside the shop in a special room.

175.0 ACOUSTICAL PLANNING. The purposes of the acoustical design of any one room will vary with the use of the space; and the methods used for acoustical correction will involve not only this use, but also the shape and size of the room, the materials used, the ratio between absorptive and reflective materials, and the placement of these materials.

175.1 General Requirements. The following requirements for good acoustics are generally applicable to all rooms:

a. The reduction of transmitted sounds to levels which will not interfere with hearing.

b. Proper diffusion of sound, and proper sound reinforcement.

c. Optimum reverberation time.

Reverberation time is the time required for a specified sound to die away to one-thousandth of the initial pressure. The optimum reverberation time varies with the frequency of the sound and with the size of the room.

175.2 Control of Reverberation Time. The reverberation characteristics of a room can be controlled by the amount and placement of absorptive materials within the room. The amount can be determined by calculation. The placement will vary with the type of room. In general it should be placed to reinforce sound, to avoid reflectance from the rear wall, to avoid flutter between parallel side walls, and to promote even diffusion. In a classroom, for example, it may be more effective to place the absorptive material on the side and rear walls of the room instead of the ceiling. However, the prime considerations to be used in determining the location of the acoustical materials in classrooms should be: (a) economy—if a suspended ceiling is required it would seem more economical to install an acoustical ceiling than a plaster ceiling: (b) protection from abuse—a soft acoustical tile will be subjected to less abuse on the ceiling and upper wall area than on the lower wall. Other considerations would be ease of maintenance; cost of installation, aesthetics, etc.

176.0 ACOUSTICAL TREATMENT

176.1 Spaces

a. All spaces useable for instruction or study, including laboratories, all permanent gymnasium-auditoriums, and all corridors and unenclosed stair halls should be acoustically treated against excessive reverberation and, where conditions warrant, transmission of sound.

b. It is highly recommended that auditoriums, lunchrooms, gymnasiums, offices be so treated. Even main toilet rooms and locker rooms will benefit by acoustical treatment.

176.2 Qualities of Materials

a. Acoustical materials rated "fire-resistive" are recommended.

b. Acoustical materials used in exit passages, corridors, lobbies, and places of assembly should be at least flame-resistant.

c. Acoustical materials should be such that cleaning or other renewal of the surface will not appreciably lower their absorptive qualities nor reduce their light reflection coefficient.

177.0 ACOUSTICAL DESIGN STANDARDS. Criteria to aid the acoustical designer in the quantitative evaluation of school facilities are given in Table I on opposite page, Sec. 177.1. They should be useful in the selection of acoustical materials and construction, most of which are adequately designed based on average frequencies of a single middle frequency of sound waves.

177.11 Reverberation Time in Rooms. Col. (2) Table 1, Reverberation Time Control, lists those rooms where there will be a normal level of useful sound, and only the control of the sound reflection is necessary to the efficiency of perception.

Note: It should be noted that in the spaces in which Reverberation Time Control only is indicated, it should be carefully determined that the background noise level will not often be greater than that listed in col. (5), Table I.

177.12 Noise Reduction. Col. (3) Table I, Noise Reduction, lists those spaces where the high level of necessary sound needs additional absorption over that which is best for the reverberation time. Noise reduction:

(1) Aids in maintaining a reasonable level for speech issuing simultaneously, and brings very high sound levels down to more nearly comfort levels.

(2) Helps in the difficult job of reducing noise levels in adjacent spaces by absorbing some sound energy before the sound is transmitted to another space, thus reducing the amount of sound insulation needed between rooms.

177.13 Internal Sound and Noise Levels. Col. (4) Table I. Noise Criterion Curve, refers to the standard curve used to establish noise tolerance in several frequencies and should be used where necessary to assure balanced noise control.

Sound Level Produced, Col. (5) Table I, indicates the sound which may be anticipated when the rooms are used in a normal manner for the usual activities associated with them. The figures are in Scale A, Sound Level Meter decibels (dba).

Tolerable Noise Level, Col. (6) Table I, refers to the background sound intensity and the figures indicate the general upper limit of this noise in Scale A. Sound Level Meter decibels (dba) beyond which undesirable hearing conditions or disturbance may exist.

Columns (5) and (6) may be used to determine the difference between the tolerable noise level in any room and the sound level assailing it from an adjoining room or outside, in determining the attenuation or transmission loss necessary to be provided for the room receiving the noise.

178.0 CRITICAL SPACES

178.1 Classroom Acoustics. While a desirable reverberation time is readily achieved in any ordinary classroom, 177.1

TABLE I—SOUND CONDITIONING NEEDS

Room or Space See Section:	Requires Reverberation Time Control 177.11	Requires Noise Reduction 177.12	Noise Criterion Curve 177.13	Sound Level Produced 177.13	Tolerable Noise Level Scale A dba 177.13
(1)	(2)	(3)	(4)	(5)	(6)
Administration, offices			NC 30	55–80	40
Auditorium (Assembly)		*	NC 25–30	80–100	35–40
Auditorium (Theatrical)	#	*	NC 20–25	80–100	30
Business Room	#		NC 25	55–80	35
Typing, Office Machines		*	NC 50	55–80	60
Classrooms, Labs	#		NC 25	55–80	35
Corridors, Lobby, Stairs		*	NC 30	60–80	40
Guidance Office	#		NC 30	55–70	40
Gymnasium: Sports	#		NC 50	80–100	60
Instruction	#		NC 30	80–100	40
Correction Room	#		NC 30	60–80	40
Locker Room		*	NC 50	60–80	60
Health Examination Room		*	NC 30	55–70	40
Heating Rooms				60–80	
Homemaking Rooms	#		NC 25–35	55–80	35–45
Library Quarters		*	NC 30	55–70	40
Multi-Purpose					
Assembly		*	NC 25–30	80–100	35–40
Play only		*	NC 50	80–100	60
Music					
Band Room		*	NC 25	80–100	35
Choral Room		*	NC 25	80–100	35
Office, Library		*	NC 30	55–70	40
Practice Room		*	NC 25	80–100	35
Playgrounds				80–100	
Projection Room		*		70–80	
Lunchroom (dining room)		*	NC 45	70–80	55
Dishwashing Room		*		70–80	
Kitchen, Serving Center		*	NC 45	55–80	55—(hood fan on)
Rest Rooms		*	NC 30	55–70	40
Sound Studio		*	NC 15–20	80–100	25—(Broadcasting)
Study Hall		*	NC 30	55–70	40
Toilets, general		*	NC 40	60–80	50
Toilets (1–3 fixtures)				55–70	
Vocational Labs, Shops		*	NC 25–40	80–100	35–75
Drafting Room	#		NC 25	55–80	35

#See recommendation Sec. 177.11.
*See recommendation Sec. 177.12.

Adapted from SCHOOL PLANNING MANUAL, page 73-2, State Department of Education, Richmond 16, Virginia.

background noise level and good frequency balance are equally important. However, the greatest loss in sound quality occurs in the search for modification of classroom planning to get more of some other qualities—low cost construction, open feeling, aesthetics characterized by glass, or other patterns.

178.2 Music Department Acoustics

Rehearsal Rooms. Band music rehearsal rooms are generally too small for the volume of sound created. This leads to the conclusion that maximum sound reduction should be designed for these rooms; however, there is some difference of opinion about this. It makes more difficult individual hearing in the room, and unless all frequencies are carefully balanced in reduction, some distortion will result. Control of low frequencies is important. Acoustical treatment is recommended for ceiling and upper walls. See Section 177.1.

Chorus (choral) Rooms. Choral and general music rehearsal room acoustics should be designed for uniform response of all frequencies.

The volume of sound in these rooms will make it necessary to insulate carefully. The transmission of sound by the building construction should be analyzed.

178.3 Library Acoustics. In elementary school libraries where considerable class activity is carried on, and less individual reading, minimum reverberation control and good sound insulation from extraneous noises should be adequate.

In high school libraries, the larger size and greater use for reference and reading indicate the need for maximum noise reduction.

178.4 Auditorium Acoustics. The following conditions peculiar to school auditoriums may affect the design:

a. Often too Large. The acoustical adequacy for a small audience may be as important as for a full audience.

b. Sound Amplification. Usually a sound amplification system is installed. The designer should know the policy of the school authorities and design accordingly. In any case sound motion pictures use should be anticipated.

c. Surrounding Rooms. Often the auditorium is closely surrounded by other spaces in which school activities are being conducted simultaneously with the auditorium program. Sound transmission either way should be investigated and controlled.

d. Children's Voices. Auditorium programs, particularly in elementary schools, will be projecting children's voices to a large extent. The higher frequencies and lower intensities of their voices will affect the auditorium size and acoustics.

e. Seating. Schools often use upholstered seats.

178.5 Multipurpose Room Acoustics. Large rooms used for a variety of activities cannot usually have ideal acoustics for all purposes. Where a major use is planned, the sound conditioning should be planned accordingly. The presence of a stage is not necessarily indicative of auditorium acoustics, as lunchroom or recreational school use of the space may make greater demands on sound conditioning. In the latter case, sound amplification may be necessary for speech programs.

178.6 Lunchroom Area Acoustics. Where dining only is planned for a room, sound absorption should be more than indicated in standard tables to provide minimum reverberation time for the room volume.

Kitchens, serving areas and dishwashing rooms are noisy in the higher sound frequencies, and should be treated for maximum absorption. However, this will necessitate a cleanable type of acoustical material. It may be more economical to provide insulation in some of the wall construction, since the primary reason of reducing kitchen noises is for the acoustics of the lunchroom or other instructional spaces adjacent.

178.7 Corridor Acoustics. Due to the transmission of sound from one room to another by means of the corridor, it is essential to have maximum possible absorption in interior corridors. In buildings where corridor walls are bearing walls, sound insulation is usually present. In other types of construction, sound transfer to other spaces should be carefully limited.

178.8 Toilet Room Acoustics. Flush valves in toilet rooms are a serious cause of noise in schools. The small volume and glazed surfaces absorb little sound. Serious consideration should be given to the elimination of noise sources, to efficient noise reduction, and sound insulation for the benefit of any adjacent teaching spaces. These will involve the following:

a. Use of quiet type toilet bowls and flush valves; elimination of water hammer.

b. Planning so no flushing fixtures are located on walls with classrooms on the other side.

c. Sound insulation in all walls; complete sound insulation of walls where toilets back up to classrooms, including insulation of sound transmitted through the construction.

d. Maximum noise reduction on ceilings and upper walls.

179–189 Reserved for future use.

SECTIONS 190-209. LIGHTING AND FENESTRATION

Section

190.0 RESPONSIBILITY. Recommendations: The lighting design for new school buildings and for major alterations to existing buildings should be prepared by a registered professional engineer, classified as an electrical engineer. He should be qualified by registration as required by M.S. 326.02 and experienced in the lighting design of school buildings.

191.0 LIGHTING STANDARDS. Except where this Guide requires or recommends otherwise the provisions as published in the latest issue of the American Standard Guide for School Lighting* and the I.E.S. Lighting Handbook, 3rd Edition, should be applied to the design and the component parts of the lighting system including all elements of both electric lighting and daylighting.

192.0 LIGHTING, GENERAL. The following sections are devoted to establishing criteria of good illumination for the assistance of those interested in appropriate lighting. Further knowledge and experience in lighting design will be required for the interpretation and practical application of these recommendations.

192.1 DEFINITION OF GOOD LIGHTING. Lighting is good when it provides enough illumination to see efficiently for a particular application or task with brightness controlled to create a comfortable and interesting interior.

192.2 TERMINOLOGY. The following terms are used in this article:

Footcandle. A unit of illumination—a measure of the amount of light falling on a surface.

Footlambert. A unit of brightness—a measure of the brightness of an illuminated surface. For a diffuse reflecting surface, it is footcandles times the reflection factor. For a diffuse transmitting media, it is footcandles times the transmission factor.

Brightness Ratios. The relationship in footlambert brightness between two surfaces.

Reflection Factor. The percent of incident light reflected from a surface.

Tasks. Any visual task which may be encountered in a classroom, e.g., a book, handwritten material, a chalkboard with symbols, laboratory apparatus, art work on easel, exhibits on tackboard. Tasks may be either in a horizontal or vertical plane and may require the pupil to face in any direction. The most severe visual tasks in schoolrooms are those which have small characters or elements with low contrast. Sewing with black thread on black cloth is an extreme example. These tasks require a high level of illumination to accentuate any brightness differences. Other tasks are relatively easy, such as sewing with dark thread on light cloth. These would require less illumination for equal visibility.

Section

193.0 DESIRABLE GENERAL CONDITIONS

193.1 VISUAL ENVIRONMENT:

a. For visual comfort and efficiency, brightness balance as well as footcandle level is important.

b. For optimum seeing conditions, it is desirable to maintain the established brightness differences between the task and significant areas of high and low brightness in the visual field.

c. Common sources of high brightness are direct sunlight, a bright sky vault, sunlight on adjacent light colored buildings, snow cover on the ground, and electric light fixtures. It is necessary to control or reduce the brightness of these sources.

d. Common sources of low brightness are ceiling, walls, floors, furniture, and chalkboard. It is necessary to increase the brightness of these commonly darker areas.

193.2 BRIGHTNESS RATIOS. The following ratios are recommended as desirable limits. These ratios would apply to the visual pattern within the classroom regardless of the source of light and also to the outdoor surfaces which are visible from the room.

TABLE 1. LIMITS OF BRIGHTNESS RATIOS

Conditions	Where X-Task Brightness in Footlamberts
a. Between the seeing task and immediately adjacent surfaces such as between the task and desk top, with the task the brighter surface.*	Not less than ⅓ X
b. Between the task and the more remote darker surfaces in the surrounding visual field, such as between the task and the floor	Not less than 1/10 X
c. Between the task and the more remote lighter surfaces in the surrounding visual field, such as between the task and the ceilings.**	Not more than 10 X
d. Between luminares or windows and surfaces adjacent to them in the visual field.	Not more than 20 to 1
e. Anywhere within the visual field of view.	Not more than 40 to 1

*Chalkboard and some art and shop tasks are illustrations of cases where the reverse ratio of 3 X may apply.

**These ratios apply to areas of appreciable size as measured by the solid visual angle subtended at the eye. Luminous areas on luminaires are generally small in size in this respect. For the brightness limitations of luminaires, see Section 194.1.

193.3 FOOTCANDLE LEVELS. The footcandle values in Table 2 following will produce lighting levels considered to be desirable and economically practical at the present stage of development in the field of illumination. These levels are to be calculated or measured using the electric lighting system only and are based on an average maintenance factor of 70 percent.

---

*Published by: Illuminating Engineering Society, 345 East 47th Street New York 17, N.Y. (Price: 50 cents)

TABLE 2. RECOMMENDED AVERAGE "MAINTAINED IN SERVICE" FOOTCANDLES ON THE TASK

Space	Maintained Footcandles#
Classrooms, study halls, offices, laboratories	70*
Drafting rooms	100
Sewing, sight saving, lip reading rooms	150**
Art rooms	70
Shops	100**
Libraries	70
School lunch dining rooms (not for study)	30
School lunch kitchens	30
Kitchen storage area, school lunch	15
Elementary playrooms	30
Gymnasiums (also for TV broadcasts)	50, TV–100
Swimming pools: General lighting	10*
NOTE: For underwater lighting—100 lumens per square foot of pool surface	
Auditoriums (not for study)	15
Corridors and stairhalls	20
Locker rooms, team rooms, toilets	20
Entrances, porticos, walks	5
Parking areas, and protective lighting	½
Football field lighting	20–30

#Recommendations are generally based on revised IES tables.

*Plus supplementary lighting where required.

**Obtained with combination of general lighting and supplementary lighting where required.

193.4 REFLECTION FACTORS

193.41 Painting and finishing are important factors in the efficiency of the lighting system and in controlling the brightnesses and brightness differences in the classroom. The following reflectances are recommended:

Surfaces	Reflection Factors
Ceilings	85%—(70–90%)
Window Walls (pastel colors)	80%—(75–85%)
Other Walls	60%—(50–70%)
Trim	40%—(30–60%)
Desk tops	40%—(35–50%)
Floor	30%—(20–50%)
Chalkboards	15%—(5–20%)
Tackboards	40%—(30–60%)
Furniture	35%—(25–40%)

193.42 Surface finishes should be flat diffuse on all interior surfaces at eye level and above. Semi-gloss finishes are not recommended but are acceptable on surfaces below the eye level for areas where frequent cleaning is necessary. Desk tops should have a flat non-glossy finish. Within the above limits, walls may be painted in any colors which are aesthetically and psychologically suitable. Limited areas of darker accents would be acceptable.

194.0 ELECTRIC LIGHTING SYSTEMS

194.1 BRIGHTNESS LIMITATIONS OF LUMINAIRES. As a guide in luminaire selection for the range of footcandles given in the table of lighting levels (Section 193.3 Table 2), the "Scissors Curve Graph" (No. 1) is recommended for determining brightness for both crosswise and lengthwise of the luminaire.

DIRECT GLARE LIMITING BRIGHTNESS GUIDE

Graph No. 1 Scissors Curve. Direct glare should not be a problem in 30 to 100 footcandles fluorescent installations if ceiling and wall reflectances comply with Section 193.41, and luminaires have crosswise and endwise brightness distributions falling entirely below any straight line drawn through 250 footlamberts at 75 degrees (line D) lying between the two limiting curves A and B. In the example above, line D drawn through point 0 and tangent to luminaire brightness curve C indicates luminaire brightness (Curve C) satisfies this criteria.

Observance of these limits should reduce glare from any luminaire under normal circumstances of installation and room decoration. Higher values than those shown may be acceptable where care is taken to use light colors and matte finishes in the lower as well as in the upper parts of the room. In these cases, an accepted method of comfort evaluation should be used to verify that the installation will be comfortable.

194.2 REFLECTED GLARE*. Specular light reflected from the stroke of a printed or written letter tends to reduce the contrast between the stroke and the immediate background, thereby reducing visibility. In severe cases this loss would be equivalent to reducing the light level to a fraction of that used. Essentially this is a reflection of the light source in a minute specular surface and is particularly a problem in pencil writing.

Several methods are available to reduce this specular reflection. Among these are the following:

(1) Use of matte surfaces—approaching blotter-like finish—whenever possible.

(2) Have as much light as possible reaching the task from an area outside the overhead "critical cone" of reflected glare. (Luminous ceilings provide wide angle components of light that reduce reflected glare.)

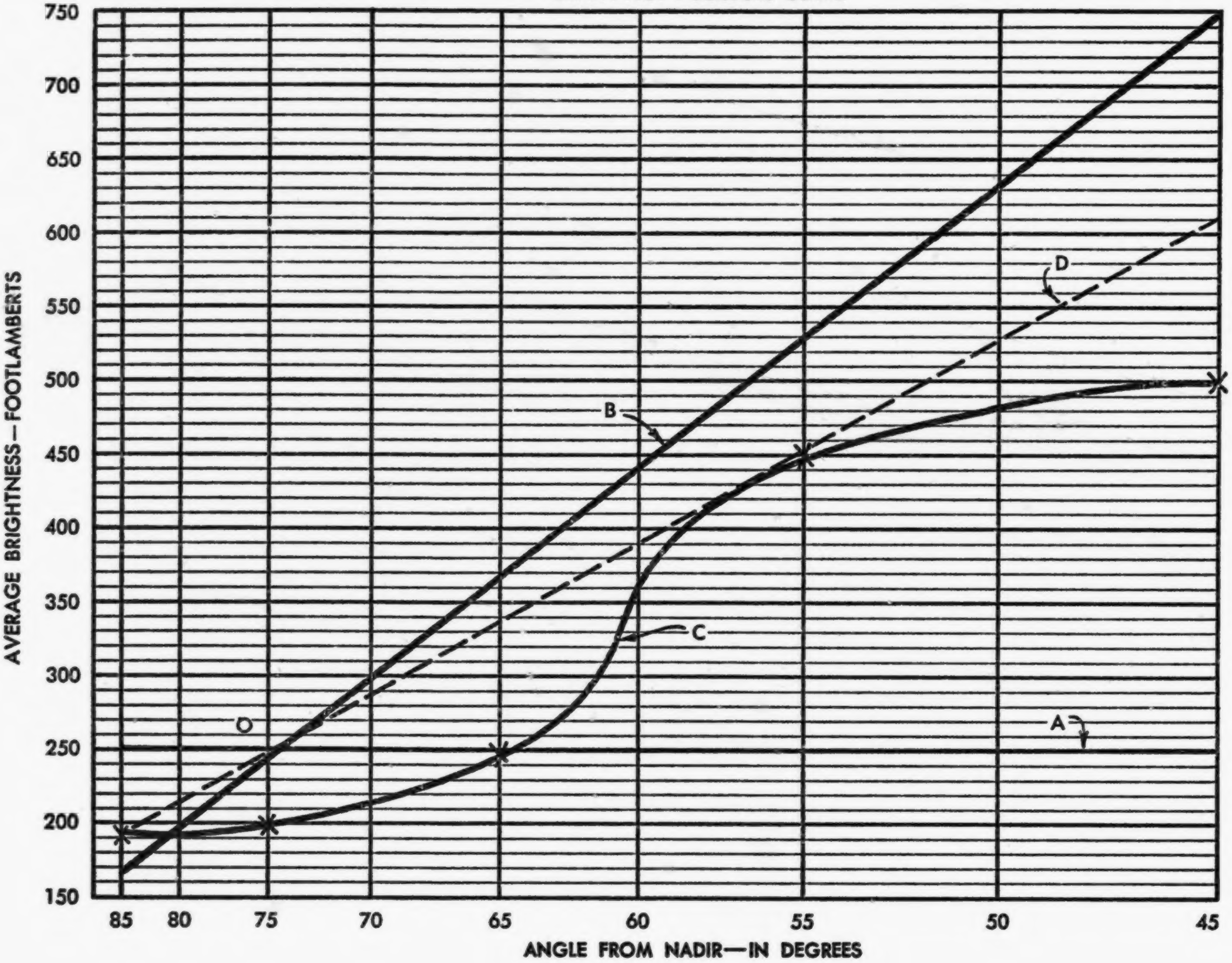
(3) Use of polarized light diffusers to reduce surface reflections at certain viewing angles.

(4) Providing light floors, walls and ceiling surfaces to help reduce the reflected glare by contributing to (2) above.

---

*Refer to Par. 2.5.3.3. in American Standard Guide for School Lighting for a more detailed coverage of this subject.

GRAPH NO. 1 SCISSORS CURVE



Example of luminaire average brightness plot ("C") and limiting guide line (dashed line.)

MAXIMUM TO AVERAGE LUMINAIRE BRIGHTNESS RATIOS

To prevent distracting nonuniformity in brightness, the ratio of maximum (for any 1 sq. in.) to average luminaire brightness at that angle (on curve "C" above) should preferably not exceed 3 to 1, and must not exceed 5 to 1. (In no case should the maximum brightness for a given angle be more than 3 times the brightness value shown on the sloping solid line B for that angle.

Crosswise

Angle	Maximum	Average	Ratio
45°			
55°			
65°			
75°			
85°			

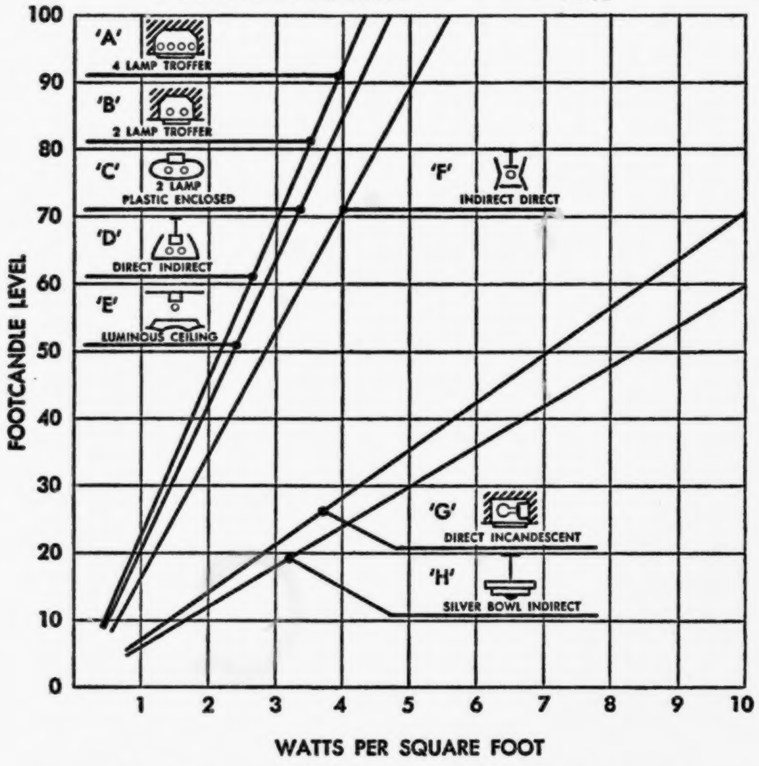
Lengthwise

Angle	Maximum	Average	Ratio
45°			
55°			
65°			
75°			
85°			

CHART 1

ESTIMATED LIGHTING LEVELS*

Wall Reflectance	50%
Ceiling Reflectance	80%
Floor Reflectance	30%
Maintenance Factor	70%



The table is based on the reflectance factors as shown above for an average size classroom (30′ x 30′ with 9′0″ ceiling) occupied under normal conditions (10% interception factor).

For smaller rooms, footcandle levels will be lower and for larger rooms, higher than shown.

---

*For estimating only.

Section

194.3 Footcandles Versus Watts per Square Foot. The graphic Chart I, (at the top of the page) may be used for estimating watts per square foot to be provided to maintain desired footcandle levels for types of lighting installations found in schools.

Explanation. In using Chart I, note that the incandescent light sources have a rated wattage on lamps; fluorescent light sources may be estimated at 50 watts for each 4 feet of lamps, or 100 watts for each 8 feet of lamp, or 100 watts for 2 four-foot lamps per fixture.

a. Example: To estimate footcandle level from known wattage.

Existing room is 24′ x 32′ (770 square feet) with 9′ ceiling.

Equipment supplied: Type "D" fluorescent (4 foot, 2 lamp fixture).

Two rows of 7 units each.

Total lighting: 14—2 lamp, 4 foot units.

Total wattage @ 100 watts per 2 lamp, 4 foot unit = 1400 watts

$$\frac{\text{1400 Watts}}{\text{700 Sq. Ft.}} = \text{1.85 Watts per sq. ft.}$$

Section

From Chart I, it is indicated that, for the Type "D" fluorescent fixture supplied, 1.85 watts per sq. ft. provides 40 footcandles average level of illumination.

b. Example: To estimate wattage requirements from footcandles.

Room size is 28′ x 40′ (840 sq. ft.) with 9 foot ceiling.

Equipment supplied: Type "D" fixture—40 footcandles measured.

From Chart I, it is indicated that for Type "D" fixtures providing 40 footcandles, 1.85 Watts per sq. ft. are required.

840 sq. ft. @ 1.85 watts per sq. ft. = 1554 watts.

There is indicated @ (100 watts per 2 lamp, 4 foot unit) a need for 15.44 or 16 type "D" fixtures.

194.4 DESCRIPTION OF SOME TYPES OF LIGHTING INSTALLATIONS SHOWN ON CHART I

194.41 Fluorescent Lighting:

a. Type "A": Direct units—recessed or surface mounted four lamp, shielded fixtures, installed in continuous rows or individually.

b. Type "B": Same as Type "A" except two lamp equipment.

c. Type "C": Semi-direct unit, surface mounted or stem mounted two lamp plastic enclosed, installed in continuous rows.

d. Type "D": Direct-indirect units, suspended, two lamp, shielded fixtures installed in continuous rows.

e. Type: "E": Luminous ceiling—luminous panel extended to cover an entire classroom. Fluorescent lamps are installed on the ceiling above the translucent plastic, creating a highly diffused source of lighting.

f. Type "F": Indirect-direct units—suspended, single lamp 800 MA., or 1500 MA. shielded fixtures, installed in continuous rows.

194.42 Incandescent Lighting

a. Type "G": Direct units of the recessed type with a low brightness lens using 300 watt clear lamps.

b. Type "H": Indirect units of the stem mounted type with concentric ring louvers surrounding a 500 watt silver bowl lamp.

194.5 Color of Fluorescent Lamps. There are seven different colors of white fluorescent lamps generally available. Of these, the standard cool white lamp, the white lamp, or the standard warm white lamp is recommended for most areas and will be satisfactory. For more accurate color discrimination—art rooms, home economic rooms, lunch rooms, the deluxe cool white lamp or the deluxe warm white lamp will give better color rendition. These lamps are less efficient than the standard or white lamps and should be compensated for in the initial design.

194.6 Suspended Type Fixtures. The minimum distance from the floor to the bottom of the suspended type lighting fixture should be 8 feet. This eight-foot mounting height is directly related to the distance between fixtures. The light distribution over an area will vary with the mounting height

Section

and spacing of fixtures, depending upon the distribution characteristics of the fixtures.

194.7 Sound Ratings of Fluorescent Ballast. Control of the sound quality within any one room can be improved by holding to a minimum the audible noise of the fluorescent lamp ballast. This can be achieved by specifying a ballast with a low sound rating for lighting fixtures in quiet and semi-quiet areas.

For maximum sound control, Type "A" sound rated ballast is recommended. Type "B" sound rated ballast would give a minimum and acceptable sound control. For non-quiet areas—shops and gymnasiums—a Type "C" or "D" sound rated ballast would be acceptable.

Fixture design should eliminate the amplification of the ballast hum. Fixture mounting methods should eliminate transmission of sound to the building framework.

194.8 Dimmers, Classroom. Provision should be made to vary the lighting level in the room to adapt to visual teaching aids. These methods could include:

(1) Dimming of all the fluorescent lighting system.
(2) Using an auxiliary direct or indirect lighting system, controllable from zero to 5 footcandles.
(3) Dimming of an auxiliary indirect light associated with the projector equipment.

195.0 PROTECTION AND PARKING LOT LIGHTING

195.1 Protection Lighting. Suitable provisions should be made for building perimeter protective lighting, automatically controlled by a time switch or photo cell.

195.2 Parking Lot Lighting. All parking lots should be provided with lighting, manually controlled.

196.0 DAYLIGHTING AND DAYLIGHT CONTROL

196.1 General

a. The provision of natural lighting in classrooms should be concerned with such matters as: (1) the elimination of excessive glare, solar gain and heat loss, (2) the elimination of excessive brightness contrasts, (3) the meeting of the psychological needs of pupils to see out and not feel walled in, (4) the minimizing of costly light control devices.

b. The design of windows and natural lighting may be varied, as may the size and shape of the classroom, provided such variations do not seriously conflict with the lighting objectives now generally accepted. For providing additional daylight in non-instructional areas, some schools have used sky dome lighting effectively. If used in instructional areas, sky domes should be equipped with light control devices.

196.2 Daylight Control

a. Brightness Control. Provisions should be made for brightness control of daylight to achieve the ratios indicated in section 193.2, Table 1.

b. Devices. Devices for daylight control include venetian blinds, single and double draw shades, draw drapes, exterior or interior baffles, and low transmission transparent glass.

Section

c. Darkening. In classrooms or designated rooms, control devices should include means of reducing the lighting level to a condition satisfactory for the use of audio-visual teaching aids with sufficient darkness for opaque projection. Such devices include venetian blinds, opaque plastic draw drapes, or channeled opaque pull-down shades. For use of classroom dimmers, see 194.8.

d. Installation. Provision should be made to facilitate the installation of venetian blinds, window shades, or drapes at all classroom windows at the completion of the building.

197.0 WINDOWS (FENESTRATION)

197.1 Glass Area

a. General. Large or unusual glass areas are uneconomical to maintain and, due to glare, do not always provide visual relief from the room area. It is the general concensus that when glass areas are large, the problem of satisfactorily handling light intensity, brightness, glare, heating, cooling, and pupil safety (shattering due to blast) is substantially increased.

b. Ratio—Exterior Wall. Conventionally, windows have extended a total of three-fourths or more the length of the exterior classroom wall. Many schools today, by using one-half or less of the length of the exterior classroom wall for windows, have added valuable instructional wall space to the classroom. In addition to decreasing daylight control problems, this increased wall space is better suited to the application of new technologies in education, such as the use of many different types of visual teaching aids.

Note: Some glass area on exterior walls is recommended.

c. Vertical Limits. Window areas of classrooms, vertically, should be limited to the approximate space between the eye level of the seated pupil and the eye level of the standing teacher, but not over door height, nor exceeding 4 to 4½ feet. Window areas of classrooms in excess of the suggested vertical maximums will be subject to question in approving plans.

197.2 Frame Materials and Types. Window frame materials may be of wood or metal and should be selected on the basis of long life, low maintenance construction and finish. Steel windows should be either hot dip galvanized or have other permanent finish requiring no field painting. Window frames should be firmly and securely set in the wall with weather proof caulking at all contacts, and with sill sloped to shed water beyond the building wall.

Types. Double hung windows, projected windows, and awning windows are all practical for use in schools. Some schools have used sealed double glazed type windows with some space between the panes to greatly increase thermal insulation for both heating and cooling. A type of curtain wall window offers a self-contained venetian blind placed between two panes of glass enclosing a 2″ air space (unsealed).

197.3 Height of Window Sills. Ground brightness near the line of sight may present excessive glare, especially sunlight on snow. To help overcome this problem, where conventional fenestration is used, the following window sill heights are recommended:

Grades	Suggested Heights from Floor
Kindergarten 1, 2, 3	2′6″
Grades 4, 5, 6	2′8″
Jr.-Sr. High School, Grades 7–12	3′0″

Section

197.4 OTHER GENERAL CRITERIA

a. Windows in instructional spaces should be operable for the free circulation of fresh air unless a balanced heating and air conditioning system for the year around use of classrooms is provided.

b. Fenestration units which distort vision should not be used.

c. The distance from a school room window to any adjacent obstruction should be at least twice the height of that obstruction above the sill of the window. Twenty-five feet is a minimum, but 40 to 60 feet is desirable.

197.5 WINDOWS IN GYMNASIUMS AND LOCKER ROOMS

Windows in gymnasiums should be arranged so that backstops used during class time will not appear dark against a bright window background. Gymnasium and playroom windows should be of a type that can be left open during rainy weather.

Windows in dressing rooms and shower rooms should have operable sash with a window stool height of 5′-6″ or more. Locker, shower and basket rooms should have windows on the sunny exposure, if possible, and glazed for privacy.

197.6 KITCHEN AND STOREROOM WINDOWS. Kitchen (cafeteria) and storeroom windows should be security type and provided with insect screens. Kitchen windows should have brightness and glare control provided by other means than shades or venetian blinds since these accumulate dirt and grease excessively.

198.0 WINDOWLESS CLASSROOMS

198.1 INTERIOR WINDOWLESS CLASSROOMS. When, in planning a school building, classroom areas are grouped into a compact design, there may be interior instructional areas with limited window spaces or without windows. To stimulate the environment in these interior spaces the following must be considered:

(1) Levels of illumination and brightness balance that will create a stimulating atmosphere.

(2) Light colored surfaces, walls, ceilings, floor and furniture.

(3) Total climate control: Heating, cooling and humidity.

Under these conditions windowless, interior classrooms will provide a good teaching station.

198.2 SUBTERRANEAN FACILITIES. If the need for subterranean fall-out protection dictates the use of such spaces for classroom and other school purposes, criteria for approval other than structural design, would be basically a totally controlled environment in respect to lighting, heating, cooling and humidity.

Section

199.0 CEILING HEIGHTS, MINIMUMS

199.1 GENERAL. Lowered ceiling height, which often accompanies top lighting is desirable in many ways, particularly in reducing the cost of construction as well as heating. However, each suggested design must be evaluated in terms of many factors, not the least of which is satisfactory solution of problems of heat gain and heat loss as well as those of lighting.

199.2 RECOMMENDED MINIMUM CEILING HEIGHTS

199.21 Instructional Rooms:

a. Elementary Classrooms (K, 1–6)—8½ feet.

b. Secondary Classrooms (7–12)—9 feet.

199.22 Other Areas: (The figures in ( ) are more desirable)

Space	Height in Feet
Administrators and teachers rooms	8½
Auditoriums with stage	*
Band and choral rooms	12–14*
Corridors:	
Elementary building	8
Secondary buildings	8½
Gymnasiums:	
Elementary schools	18 (20)
Junior secondary schools	20 (22)
Senior secondary and combination schools	22#
Multipurpose and playrooms, elementary	14
Primary playrooms, grades 1–3	9
Lunchrooms:	
Kitchens	10
Dining areas	9 (10)
Shops:	
Industrial arts, depending upon type	10–14
Vocational shops, depending upon type	10–16
Shower and dressing rooms	9–10
Toilets	8–9

---

*Based on capacity and acoustical analysis.
#Higher if basketball backboards are raised for other games.

200-209 Reserved for future use.

SECTIONS 210-229. PLUMBING AND SANITARY FACILITIES AND TRIM

Section

210.0 GENERAL REQUIREMENTS, NEW BUILDINGS. All new school buildings are to be provided with pressured water system and water flushed plumbing fixtures conforming to the standards stated herein.

211.0 PLUMBING CODES AND STANDARDS. The plumbing, gas piping installation, sanitary engineering, materials and equipment, are to conform with the current issue of the following standards and codes wherever applicable and to the standards stated in this guide.

a. The Minnesota Plumbing Code.

b. Local plumbing and sanitary codes in effect.

c. Water Supply and Sewage Disposal requirements and recommendations of the State Board of Health.

d. Sanitary recommendations of the State Department of Health, regarding food preparations and dining areas.

e. Minnesota Fire Marshal's Good Practice Rules for Liquefied Petroleum Gas Piping and Appliance Installations in Buildings.

f. NFPA Standards: (NFPA No. 54) (NFPA No. 58) (NFPA No. 59).

212.0 RESPONSIBILITY FOR DESIGN. Recommendation. The plumbing design for new school buildings and for major alterations and additions to existing buildings should be prepared by a "Registered Professional Engineer," duly qualified by registration as required by M.S. 1945 Sec. 326.02, as amended. Such engineer should be experienced in the design of plumbing systems.

213.0 WATER SUPPLY

213.1 GENERAL REQUIREMENTS:

213.11 Minimum Supply. There should be an abundance of water available at all times for present and foreseeable expanded needs, at least 15 gallons per person per day for schools without kitchens or showers, increasing this to 20–30 gallons per pupil per day with kitchens and showers.

213.12 Safe Supply. The water must be initially safe for drinking and domestic use and maintained safe by protection of source of supply, treatment if necessary, and periodic analysis.

213.13 Treatment. Water analysis, bacteriological and chemical, should be made when necessary. Appropriate steps should be taken to alleviate any undesirable condition.

213.14 Approval. Where an approved public water supply is not available, provision for water must be made in accordance with the recommendations and regulations of the Minnesota State Board of Health.

213.15 Unsafe Water. The approved water supply should be piped to all plumbing fixtures in the building and there shall be no connection or other arrangement whereby unsafe water may be drawn or discharged into the approved water supply.

213.2 MAINS AND BRANCHES

a. Water supply mains and branches should not be run under slab. Where there is no other approach, runouts to single fixtures may be run under slab in conduit so that piping may be insulated and replaced.

b. Each fixture, each main, and each article of equipment should be valved for isolation. All low points should be capped or plugged for drainage except normal drain points should be valved with hose end valves for draining.

c. Fabricated shock absorbing devices should be used. If the water pressure at the main exceeds 60 psi, each supply to each fixture, except those within 8 feet developed length from a 1-inch diameter or larger main shall be equipped with shock absorbing devices. Groups of fixtures may be protected as a group. All fixtures with quick opening valves should have shock absorbing devices. A main shock absorbing device should be located on the service side of the meter when deemed necessary by the engineer.

213.3 DOMESTIC HOT WATER TEMPERATURES. Recommended temperatures at outlet:

	Degree F.
School lunch kitchens, all locations	140–160
Sanitizing rinse water (required)	180
Home economics kitchens, vocational laboratories, custodian's sinks	140
Showers (with automatic controls)	120
Pupil sinks and lavatories, except in classrooms	140

213.4 OTHER HOT WATER HEATING.

a. If the heat generating system is interruptible gas fired, water should be heated by indirect water-to-water (or steam to water) heat exchangers for fuel economy.

b. In buildings containing food service facilities, the water for sterilizing shall be boosted from 140 to 180 degrees F. Under no circumstances should the entire water quantity be heated to 180 degrees. If the heat generating facility is interruptible gas fired, the boosting should be by indirect heat exchanger.

c. Water controllers for tempering water for lavatories and showers should be of the thermostatic non-scald type.

d. Heated water mains should be circulated except when the total length is less than 50 feet.

e. Ferrous hot water storage tanks should be lined or otherwise protected with a material that will guarantee against failure for 10 years.

f. The capacity of the hot water storage tank and the recovery capacity of the heat exchanger should be in accordance with the current edition of the A.S.H.R.E. Guide.

213.5 PIPING

213.51 Joints. The joining of ferrous and non-ferrous piping should be avoided, but when such a joint is considered necessary and it is concealed in the earth, a wall, a partition or furred space, a dielectric coupling should be used to prevent galvanic action between the dissimilar metals.

213.52 Valves and Fittings. Valves and fittings should be selected considering ease of service and replacement. All control valves not in direct view of units served should be tagged and tags stamped with valve purpose or valve number as required. All complex piping systems should be identified.

213.53 Insulation. Thermal insulation for plumbing systems. All plumbing cold water piping, including that in walls, should be insulated with a "non-sweat" inorganic type of pipe insulation.

213.54 Compressed Air Piping. Compressed air piping and equipment should be in accordance with N.B.F.U. #565 for non-flammable gas systems as it pertains to compressed air.

213.55 Floor Drains. Floor drains are required in each boiler room and should be provided in each dressing or locker room and certain shop areas. They may be omitted from general toilet rooms, although some school planners feel that floor drains are necessary in general toilets for sanitary maintenance in case of water closet over-flow. Floor drains for shops should have removable sediment buckets so arranged as to permit easy access. Floor slopes and drains should be shown on plans.

213.56 Hose Bibs. There should be a hose bib or threaded faucet provided with a vacuum breaker in or convenient to each interior space having a floor drain.

Exterior hose bibs of the non-freeze type should be provided at convenient distances around the perimeter of the building. Consider use of "key" type.

213.6 Storm Drainage

a. Where drainage on site grade cannot be accomplished, storm water should be piped to the nearest storm sewer, natural drainage way, or public street gutter.

b. Flat roofs should be drained by large sump strainer roof drains to the public storm sewer through inside rain water leaders. No roof should pond water. Roof drains should be placed at the low points of the roof Consideration should be given to the camber of the structural members when the drains are placed.

c. Roof water should be drained on grade only where no storm water removal system is available. When drained on grade, the sidewalks and parking areas should be avoided for surface drainage.

d. Artificial drainage pits should be used only as a last resort and never in clay areas. In clay soil areas the capacity of such pits should be equal to a 4-inch rainfall for 30 minutes and such pits should be more than 20 feet deep.

e. Wherever clay is encountered in the underlying subsoil at the low areas of the building, such as boiler rooms, tunnels, basement areas, the possible need for underground drainage tile should not be overlooked.

214.0 SEWAGE AND WASTE DISPOSAL

214.1 Sewage Disposal, General Requirements

214.11 Wherever an adequate municipal sewage disposal system is available, it should be used. The design should include proper sizing and grade of sewage mains.

214.12 If no municipal system is available, an independent sewage disposal system must be designed and constructed in accordance with the requirements of the Minnesota State Board of Health.

214.13 The type of installation depends upon the character of soil, location of wells, source of water supply, and point of final discharge. The installation design requires the technical services of a professional engineer.

214.2 Waste Interception

214.21 Grease Traps. The waste from the washing sumps of kitchen, scullery or pot sinks, should be intercepted in accordance with the Minnesota Plumbing Code Section #77. Grease interceptors should not be used on sterilizing water wastes such as from dishwashers or the rinsing sumps of pot sinks.

214.22 Traps for Inflammable Wastes. When inflammable wastes are present in automotive repair shops, they should be intercepted in accordance with the Minnesota Plumbing Code (Sec. 79.). The interception of single stall shops should be by interceptor type floor drains; for multiple shops by an indirect system with inflammable waste interceptor according to the Plumbing Code.

214.23 Chemical Laboratories. The waste from chemical laboratories should be intercepted by acid waste piping to a neutralizing basin or to a frequently used branch of the sanitary building drain. The sanitary drain shall be acid waste piping construction 10 feet each way from the neutralizing basin which should be constructed according to the requirements of the State Board of Health.

214.3 Sanitary Drainage

a. Sewer ejectors should be used only as a last resort. Lifting of waste from boiler rooms and pits should be limited to clear water waste.

b. Back water valves, as well as wedge gate valves, should be used on the basement branches of the sanitary building drain whenever the drainage line is serving fixtures below the elevation of the adjacent street and the building sewer discharges into a combined sewer.

215.0 BUILDING GAS SERVICE LINES. Gas supply piping is to be provided for laboratories, shops, and kitchens with installation conforming to current State Fire Marshal's rules and applicable NFPA standards (Bulletin Nos. 54, 58, 59).

215.1 Size for Natural Gas. All gas piping should be sized for natural gas so that it may serve for either natural gas or liquified petroleum gas with a higher caloric value.

215.2 Main Supply Lines. See Section 132. Fire and Life Safety.

215.3 Gas Control Valves. See Section 132. Fire and Life Safety.

216.0 TOILET ROOMS

216.1 General Principles. Toilet rooms should be located and designed:

a. to protect health

Section

b. to promote education in health habits and hygiene

c. to minimize administrative problems

d. to minimize interference with educational activities

e. to provide comfort and convenience to pupils, staff, and public.

216.2 ELEMENTARY SCHOOL TOILET ROOMS

216.21 Kindergarten and Grade 1. Each kindergarten classroom should have at least one toilet room for both boys and girls within it and containing a water closet. The lavatory should be outside in the classroom, near the toilet room. It is desirable that individual room toilets be provided within first grade classrooms.

216.22 Grades 2-6. Grades 2-6 may well use general toilets.

216.23 Paired Classroom Toilets. A boy's toilet and a girl's toilet, each accessible from two classrooms is an acceptable, but not recommended, arrangement for primary grade classrooms and one which gives essentially the features of private toilets with some economy. The two toilet rooms should open into a vestibule connecting both classrooms. Lavatories should be in the vestibule.

216.24 General Toilets. Each floor of each elementary building should have general toilets with sufficient fixtures to accommodate those pupils on that floor who are not provided with classroom toilets and fixtures, with no less than one general toilet room provided for boys and one general toilet room for girls.

In general toilets in elementary buildings, with the exception of one lavatory inside the toilet room for emergency purposes, lavatories or handwashing facilities should be located outside of the toilet room in a corridor recess or alcove.

216.25 Private Toilets in Elementary Schools

a. In elementary schools with less than 12 classrooms, one private toilet designed to serve health room needs, faculty, and administrative staff should be considered a minimum facility.

b. In elementary schools with 12 or more classrooms, private toilets should be provided for the following:

(1) Health Unit.
(2) Administrative Staff (at least one private toilet).
(3) Teachers Rooms or Workrooms. Fixtures provided on the following basis:

Fixtures	Men per Fixture	Women per Fixture
Water closet	10	7
Lavatory	10	10
Urinal	20	

(4) Custodian. See Custodial Facilities.
(5) Kitchen Employees. See School Lunch.

216.26 Number of Fixtures for Kindergarten and Primary Classrooms Toilets

Section

Classroom Toilet	Fixtures	
	Boys	Girls
Serving Kindergarten*	1 water closet 1 lavatory#	
Serving one* or two classrooms	1 water closet 1 lavatory# 1 urinal	1 water closet 1 lavatory#

*One toilet room with a water closet and a lavatory may serve both sexes in a kindergarten or first grade room.

#Locate outside the toilet room in the classroom or vestibule near the toilet room, in which case one lavatory for both boys and girls is sufficient.

216.27 Number of fixtures for elementary general toilets. Water closets, lavatories, and urinals in general toilets for elementary pupils should be provided based on not more than the following number of pupils per fixture.

Fixture	Number of Elementary Pupils per Fixture	
	Boys	Girls
Water Closet	90(60)*	35(30)*
Lavatory	60(50)*	60(50)*
Urinal	30(25)*	

*The figure in parenthesis ( ) indicates a more desirable ratio especially for large buildings.

NOTE: At least two water closets are to be installed in each general toilet room.

216.3 SECONDARY SCHOOL TOILET ROOMS. Departmentalization with a rapid shifting of pupils between periods, indicates that efficient use of toilets may be obtained only by careful attention to location, and an ample number of toilet rooms. Toilets remote from traffic will be little used. Toilets convenient to a single facility such as a lunchroom will need extra fixtures to take care of peak loads of short duration.

It is a common practice in large buildings to provide that certain areas, such as music, industrial arts, vocational agriculture, school lunch, gymnasium and auditorium, can be locked off from the rest of the school. In such cases, it is necessary to locate toilets so that when any unit area is locked off to itself, adequate toilet rooms are included in the locked off area for the use of one or both sexes as necessary.

216.31 General Toilets for Secondary Pupils. General toilet rooms for each sex are to be provided on each floor of a building housing secondary pupils, and are to contain sufficient fixtures for the nominal pupil occupancy for that floor.

216.32 Number and Type of Fixtures. In designing secondary school toilet rooms, the total number of fixtures should be provided for the anticipated enrollment based on not more than the following number of pupils per fixture.

Fixtures	Number of Secondary Pupils per Fixture	
	Boys	Girls
Water Closet	90	30
Lavatory	90	90
Urinal	30	

NOTE: In large secondary schools with 1000 or more pupils, some adjustment may be necessary in the above schedule, particularly the girls' schedule for water closets which may be short and the boys' schedule for urinals which may be high.

216.33 Locker Rooms. Each girl's locker or dressing facility should have a minimum of 2 water closets and one lavatory; each boy's facility at least 1 water closet, 2 urinals, and 1 lavatory.

216.34 Private Toilets in Secondary Schools

a. Administration Unit. In schools with 30 or more secondary teachers at least one toilet should be provided for administrative staff. In large schools administrative people may spend enough time in the area to justify an adequate toilet facility for each sex.

See Administrative Unit, Section 100.0
Guidance Unit, Section 101.0
School Lunch, Section 105.0

b. Health Unit. The health room or health service unit in a secondary school should include a toilet. See Section 102.

c. Teachers Rooms. See Section 103.0

Fixture ratios for men and women teachers should be the same as for elementary schools. See Section 216.25b.(3).

d. Physical Education Unit. Toilets should be provided in or adjacent to the office of physical education instructors. See Section 87.46.

e. Custodial Area. See Section 110.0.

f. Kitchen Area. See School Lunch Unit, Section 105.0.

216.35 Public Toilets in Secondary Schools. Toilets for public use should be completely available to the auditorium, the gymnasium and any other parts of the school plant commonly used by the public. Public toilets need the same facilities used in pupil toilets.

216.4 TOILET ROOM ARRANGEMENTS, ALL SCHOOLS

216.41 Space. Toilet rooms should be no larger than necessary to accommodate the fixtures and anticipated traffic. A 5-foot wide passage along a row of stalls, is usually sufficient.

BASEMENT TOILETS. No toilet rooms except auxiliary toilets should be placed in basements.

216.42 Privacy. Toilet rooms with two or more fixtures, not counting lavatories, should have doors, mirrors, fixtures, and windows so arranged as to insure privacy.

216.43 Partitions and Stall Doors. Toilet partitions (stalls) should be of impervious materials, with baked enamel fixtures, if metal. Toilet compartment doors are optional, according to local thinking. It is advisable to provide one modesty toilet with doors in girls' toilets if doors are omitted. Doors on one or more of the boys' toilets should be considered, particularly if no private toilet is available for men on the faculty.

An adequate toilet stall (with door) is 2½ x 4½ feet. Doors should be flush type with substantial non-corroding hardware and rubber bumpers.

216.44 Finish. Floors and wainscots of all main toilets should be finished with impervious materials such as ceramic, glazed, or quarry tile, and all bases should be coved. Concrete is not considered an impervious material.

216.45 Lighting. Lighting should provide the foot candles recommended for toilet rooms in Section 135.4.

216.46 Ventilation. All general toilet rooms require mechanical exhaust ventilation. See Section 104.0.

216.47 Toilet Room Accessories

a. Mirrors. Mirrors at least equal in number to the lavatories should be provided in the toilet room. They should not be mounted above lavatories.

Mirror Mounting Heights. Heights apply only to the size listed.

Grades Using Mirrors	Vertical Length of Mirror	Height (Floor to Bottom of Mirror)
Kindergarten and Grade 1	24″	30″
Grades 2–6	30″	30″
Grades 7–9	30″	40″
Grades 10–12	30″	44″

b. Dispensers. The following dispensers (vandal proof) should be provided where applicable in each toilet room:

(1) A soap dispenser convenient to each lavatory.
(2) A toilet tissue paper dispenser for each water closet stall.
(3) Paper towel dispensers convenient to lavatories or other hand-washing facilities; and necessary waste containers.
(4) Sanitary napkin dispensers in the girls' toilet rooms of junior and senior secondary schools, and in toilet rooms for women teachers.
(5) A convenience shelf in secondary general toilets for pupils' books and other articles.

NOTE: The shelf should be mounted below mirrors and of sturdy design and mounting.

217.0 PLUMBING FIXTURES

217.1 WATER CLOSETS

217.11 Water Closet Locations and Number. See TOILET ROOMS Sec. 216.2, 216.3.

217.12 Water Closet Design. Water closet bowls should be of vitreous china or other approved impervious material, of the extended lip or elongated bowl type and be equipped with impervious, open front seats. Siphon jet type is recommended.

Quiet acting bowls and valves should be specified in private toilets and in general toilets where the fixtures are attached to a wall of an adjacent classroom or office.

NOTE: Minnesota Plumbing Code Section 90A requires that water closet tanks shall have elevated ball cocks and vacuum breakers.

Section

217.13 Water Closet Size and Height. See Table 218.1.

217.14 Water Closet Mounting. Wall mounted types are superior to floor outlet types in that floor maintenance and cleaning are simplified where 15″ mounting is provided. However, they will not permit proper floor cleaning if mounted at 13″.

217.15 Flush Valves for Water Closets. All toilets should be equipped with flush valves with the exception of the toilet in the homemaking unit where a tank type is preferable. Flush valves should have a non-hold-open feature to prevent waste of water. Quiet-acting water closets should be equipped with quiet flush valves. A stop should be provided in the supply piping.

Hand flush valves should be mounted 36″ to 48″ high depending on the size of pupils using them to prevent tripping them by foot.

NOTE: Minnesota Plumbing Code, Section 90A requires that flushometer valves be provided with vacuum breakers.

217.16 Flush Tanks. If low water pressure prohibits the satisfactory use of flush valves, flush tanks with locking covers should be provided.

217.2 LAVATORIES

217.21 Lavatory Locations. Lavatories or wash fountains should be provided as follows:

a. Toilet rooms. See Section 216.0
b. Physical education dressing rooms
c. Homemaking unit bathroom
d. School lunch kitchen
e. Industrial arts shops (one washing position per ten pupils)
f. Trade and industrial shops (one washing position per ten pupils)
g. Vocational agriculture shops (one washing position per five pupils)
h. Health unit or health room; or room for first aid
i. Unless worksinks suffice, convenient to duplicating rooms, guidance unit, stage dressing rooms
j. In other locations for washing before eating. See 217.22 following.

217.22 Elementary School Handwashing Facilities. It is desirable in elementary schools with lunchrooms to provide one or more handwashing fountains or lavatories in one or two alcoves off the corridor near the school lunchroom. Also see 216.2.

NOTE: One alcove and one 36″-round fountain for each 200 children should be adequate to handle the normal school lunch operation (or equivalent lavatories).

217.23 Lavatory Design. Lavatories should be of vitreous china or other impervious material.

217.24 Lavatory Supports. Concealed chair carrier mounts are preferable for lavatories. Legs to the floor give adequate rigidity but hinder cleanliness.

217.25 Lavatory Mounting Heights. See Table 218.1.

Section

217.26 Lavatory Faucets. Faucets should be durable and vandal proof while providing desirable operating characteristics. Adjustment devices and faucet handles should be keyed rather than fastened with simple screws. A keyed stop should be provided in the supply piping.

217.27 Lavatory Spouts. Where both hot and cold water are provided, mixing spouts should be used. Standard spouts with aerators are the most practicable.

217.28 Lavatory Drains. Waste openings in lavatories for pupil use should have a fixed strainer only and should not have a stopper, either build-in or loose.

217.3 URINALS

217.31 Urinal Locations and Quantities. See TOILET ROOMS Sec. 216.0.

217.32 Urinal Design. Urinals should be of vitreous china or other impervious material. Wall mounted urinals are recommended for both elementary and secondary schools.

217.33 Urinal Mounting Heights. See Table 218.1.

217.34 Urinal Flush Valves. Automatic flush valves or tanks are recommended. Exposed flush tanks, if used, should be provided a protective cover. Any exposed flush piping should be adequately bracketed.

217.4 WORK SINKS

217.41 For Classrooms. Work sinks in kindergarten and elementary classrooms should be of enameled iron or stainless steel, set into work counters. Sinks should be equipped with deck type faucets and short gooseneck supply set in the rim. Drinking bubblers, where used, should be set into the rim of the sink opposite the faucet end. Provide impervious counter top and splash back.

Work sinks, when supplied in high school laboratory classrooms, i.e., language arts, social studies, modern language, should be enameled cast iron or stainless steel, with integral back if wall type.

217.42 For Kitchens and Kitchen Work Areas. Sinks in kitchens and work areas should generally be of stainless steel, single, double, or triple compartment with drainboards, properly selected for use and space conditions.

In kitchens where dishes are manually washed, a three-compartment sink, 16″ deep should be provided. Provision for 180 degree hot water is required by the State Department of Health.

If disposals are installed, water supply to them must be provided with vacuum breakers installed 6 inches above the counter (Minn. Plumbing Code, Sec. 93A). Before installing disposal units, local regulations should be checked since some localities prohibit their use.

217.43 For Laboratories and Shops. Special sinks should be considered for laboratories and shops where requirements may be for acid waste or heavy duty. Waste and vent pipes should be acid resisting for laboratory work. The Minnesota Plumbing Code (Sec. 93A) requires that faucets or water outlets on laboratory sinks shall be provided with vacuum breakers.

Section

217.44 Work Sink Locations and Other Data. Recommended, when applicable, as follows: (Also see Sections 217.41 thru 217.43).

Location	Material	Mounting	Water	Remarks
Elem. classrooms kindergarten grades 1–6 special education resource room	Enameled cast iron or stainless steel	Work counter	Hot and cold	Impervious counter top and splash back
Sec. classrooms language arts social studies language lab.	Enameled cast iron or stainless steel	Wall or counter	Cold**	Integral back unless counter or cabinet mounted
Science lab.(s) all science subjects	Acid resisting (A.R.)	Demonstration desk	Cold*	A.R. traps, drainage and venting to dilution point
Science classroom for J.H.S. if no lab provided. Health classroom	Acid resisting (A.R.)	Demonstration desk, counter or cabinet	Cold*	A.R. traps, drainage and venting to dilution point
Preparation room Photographic dark room	Acid Resisting (A.R.)	Work counter or cabinet	Cold* Hot and cold#	A.R. traps, drainage, venting
Ind. arts laboratory	Enameled cast iron or stainless steel, cement	Wall or island	Hot and cold	A.R. in ceramic lab.
Art laboratory	Enameled cast iron or stainless steel	Double compartment peninsular or island type	Hot and cold	Sediment basket and plaster trap
Business education	Enameled cast iron or stainless steel	Counter	Hot and cold	Integral back unless counter or cabinet mount
Home economics	Enameled cast iron or stainless steel	Counter	Hot and cold	Impervious counter top and splash back
School lunch kitchen	See Section 105			
Library workroom	Enameled cast iron or stainless steel	Wall or counter	Hot and cold	
Materials production room Duplicating room	Enameled cast iron or stainless steel	Wall or counter	Hot and cold	

*Hot and cold water should be provided in demonstration desks.
**Hot and cold water desirable.
#A thermostatic mixing device for hot and cold water may be desirable.

Section

217.45 Work Sink Heights and Size. See Table 218.1.

217.5 CUSTODIAL SINKS. Custodial sinks for building maintenance should be either service sinks, mop sinks or receptors. A ½-inch water supply should be provided. The Minnesota Plumbing Code requires vacuum breakers.

Service sinks should be of acid resisting enameled iron or vitreous china, with chip-proof lip or rim. The sink should be low for convenience with the faucets high enough above the sink to permit the filling of water buckets.

A superior substitute or auxiliary arrangement includes a section of tile and cement floor and drain enclosed by a low tile curb, or a precast receptor, 6 inches deep inside. The faucet is located above in such a way that buckets can be filled without being lifted. Where receptors are used, water proof membranes should be installed.

217.51 Custodial Sink Number and Location. A custodial sink should be provided for each floor and additional ones where needed. One for each 7,500 to 10,000 square feet of floor area is suggested for efficient maintenance practice.

217.6 DRINKING FOUNTAINS.

217.61 Drinking Fountain Quantities. Not less than one properly located drinking fountain should be provided in the corridors of the building for each 90 pupils, not including pupils in rooms having drinking fountains, and not less than one to each floor.

217.62 Drinking Fountain Locations. Should be located as follows:

a. In each of the following:
  - Kindergarten and first grade classrooms, separate from work sinks.
  - Elementary classrooms, grades 2–6 (bubbler properly located on rim of work sink may suffice).
  - Special education classroom.
  - Gymnasiums, at each end, recessed, with cuspidor adjacent.
  - Physical education locker rooms.
  - All shops (in or near).
  - In library reading room.
  - In dining area of school lunch unit (one per 200 in seating capacity, equipped with glass fillers and bubblers as required).
  - Teaching units remote from corridor fountains.
  - In or near music rooms.

b. In corridors or lobbies near the following rooms or cases:
  - Elementary classrooms, unless each has a drinking fountain.
  - Secondary classrooms, laboratories, activity rooms.
  - Auditoriums and gymnasiums.
  - Health service unit.
  - Guidance unit.
  - Teachers rooms.
  - Administration unit.

Section

c. Convenient to playgrounds, on building wall or free-standing.

217.63 Undesirable Drinking Fountain Locations. Drinking fountains or bubblers shall not be located in toilet rooms. They should not be located:

a. On lavatories

b. On worksinks other than those suggested as permissible in classrooms

c. Where they will contribute to congestion, distract pupils in class, or where drinking may create a hazard to the pupil.

217.64 Drinking Fountain Design. The Minnesota Plumbing Code requires that drinking fountains shall be of impervious materials, sanitary, angle stream, guarded nozzle type. They should be equipped with an automatic pressure control device.

A fountain unit with two or more fountain jets is not recommended. If used, the fountain jets should be at least 18 inches apart with water streams flowing in the same direction. Batteries of drinking fountains in a single location in excess of two fountain units are not recommended.

217.65 Drinking Fountain Mounting. Interior drinking fountains should be wall mounted, preferably recessed. Fittings should be vandal proof. Supply lines to drinking fountains should be well insulated and shall not be run close to hot pipes or heated spaces.

217.66 Drinking Fountain Heights. See Table 218.1.

217.7 SHOWERS. Shower room design and finish are described in Section 87.0 Health, Physical Education and Recreation Unit. Common shower rooms and gang showers should be provided for boys and similar facilities for girls. One or two individual shower stalls may be provided for girls.

217.71 Shower Controls. Individual showers, either in group or private showers, should have individual control of water temperature and quantity, subject to master control.

217.72 Shower Heads. Shower heads or nozzles should be non-clogging, flush-mounted, and as vandal proof as possible. All supply piping should be concealed and pressure tested.

217.73 Number and Spacing. At least one shower head should be provided for each 3–4 pupils in the largest physical education class, intramural or athletic squad for which the school program calls for. Shower heads should be installed about 3 feet apart.

217.74 Shower Drains. Gang showers should have at least two drains. Perimeter gutter drains with domed screens are recommended. Avoid curbs.

217.75 Shower Head and Shower Valve Mounting Heights. See Table 218.1.

Section

218.0 PLUMBING FIXTURE HEIGHTS

218.1 TABLE: Recommended Plumbing Fixture Heights

GRADE	Drinking Fountains to Rim	Lavatories to Rim	Water Closets to Rim	Urinals to Lip	Shower Valve Height	Shower Head Heights	
						Boys	Girls
						(head)	(shoulder)
Kindergarten	26″	24″	15″	—	—	—	—
1–3	30″	25″	15″	15″	—	—	—
4–6	34″	27″	15″	15″	36″	55″	50″
7–9	36″	31″	15″	19″	40″	60″	54″
10–12	36″–40″	31″	15″	19″	45″	66″	56″
Public	36″–40″	31″	15″	19″	—	—	—
		Lav. Size 20″ x 18″		**Urinal Width** 18″ **Mount** at least 24″ cent. to center.	**Shower Mounting** Mount 3′ apart. Provide one for each 3–4 pupils in largest physical education group.		

NOTES:

(1) WORK SINK HEIGHTS AND SIZES

(a) Height. In elementary classrooms the height of the work sinks should not exceed the height of the work counters. See Sec. 51.33 e.

In other cases, the height of the work sinks should approximate lavatory height, above, for the appropriate grade level, but not to exceed 36″.

(2) NUMBER OF TOILET FIXTURES. See Sections 216.26, 216.27, and 216.32–216.35.

(3) MIRROR MOUNTING HEIGHTS. See Section 216.47 a.

Section

219.0 SIGNATURE ON PLUMBING DRAWINGS AND SPECIFICATIONS. The certification and signature of the "Registered Professional Engineer" preparing the plumbing drawings and specifications should be placed on the appropriate sheets of these documents. "Registered Professional Engineer" means duly qualified by registration as required by Minnesota Statutes.

Section

220.0 CERTIFICATE OF INSPECTION OF PLUMBING INSTALLATION. The plumbing contractor should furnish a copy of the certificate of final inspection of the plumbing installation, signed by an inspector of the State Board of Health, to the owner, to the architect and to the engineer before final payment is made by the owner.

221–229 Reserved for future use.

SECTIONS 230-259. HEATING AND VENTILATION

230.0 THE THERMAL ENVIRONMENT. A good thermal environment is an essential requirement for today's school buildings.

a. Good Thermal Environment provides those thermal conditions at which most students are at their greatest efficiency and comfortable. Researchers do not agree on the exact combinations of the components of a proper thermal environment. The general optimum suggested ranges are:

(1) Average air temperatures ranging from 69 to 74 degrees F.
(2) Relative humidity between 40 percent and 60 percent.
(3) Air movement of 20 to 40 cubic feet per minute.
(4) Balanced average radiant temperatures of surfaces surrounding an occupant in a room. (Radiant heat is that heat that is transmitted through space in straight lines and reflects in the same way that light does. Its transmission is independent of air).

b. The System employed for the thermal conditioning of a school building must provide sufficient heating and cooling to maintain the daily thermal environment under widely varying conditions of solar and internal heat gains and heat losses due to the outside temperature and exposure. It must also control the temperature to a reasonable degree during the night and hours when the building is unoccupied. It must permit, for evening activities and adult classes or meetings, the selective restoration of temperature and ventilation in a room or group of rooms.

231.0 RESPONSIBILITY FOR DESIGN. Recommendation: The design of the facilities for thermal conditioning of school buildings which may include heating, ventilating, air conditioning and control of radiant heat, should be prepared by a "Registered Professional Engineer," duly qualified by registration as required by M.S. 1945, 326.02, as amended. Such engineer should be experienced in designing thermal conditioning facilities for school buildings.

232.0 DEFINITIONS. Definitions of heating, ventilating, and air conditioning terms as stated in the "guide" published by the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) are applicable to these sections.

233.0 REFERENCES FOR DESIGN STANDARDS. Except where this manual specifically requires or permits otherwise, the provisions as published in the current issue of the following standards, codes, and regulations should apply to the component parts of heating, ventilating, and air conditioning equipment. Where these publications refer to the technical design and give technical data, the system design and procedures indicated should be followed insofar as they apply to the system and equipment to be used. Where ratings or capacities of equipment are referred to, they should be considered the maximum capacity of the equipment described.

Note: Local Ordinances. Where local ordinances exist concerning heating, ventilating and air conditioning equipment and design, as in the first-class cities, such ordinances, in case of conflict with the recommendations of this manual, will govern. In the absence of local jurisdictional codes, adherence to the codes of the nearest city of the first class is recommended. A building code for state buildings appears in the process of development and adoption. If adopted, this code will provide an additional reference.

REFERENCE	PUBLICATION	AUTHORITY
a: General design	Heating, Ventilating and Air Conditioning Guide	The American Society of Heating, Refrigeration and Air Conditioning Engineers
b: Fire Safety	Minn. Fire Safety Regulations	Minn. Fire Marshal
c: Fire Safety	Standards	National Board of Fire Underwriters
d: Fire Safety	Standards	National Fire Protection Association
e: Cast Iron Boilers	Net Load Rating Tables	Institute of Boiler and Radiator Manufacturers
f: Steel Boilers	Net Load Rating Tables	Steel Boiler Institute
g: Low Pressure Heating Boilers, Power Boilers, unfired Pressure Vessel, design work pressures	ASME Boiler and Pressure Vessel Code, Sec. IV Low Pressure Heat. Boilers (1956w 1957-8 Addenda)	American Society of Mechanical Engineers and Minn. State Division of Boiler Inspection, Dept. of Labor and Industry
h: Oil Fired Furnaces	Code for Testing Oil Fired Furnaces CSD, CS 195–54	National Warm Air Heat. & Air Condit. Assn. U.S. Dept. of Commerce
i: Central Heating, Gas Appliances, Steam and Hot Water Boilers	Z 21.13.1	American Standards Assn. & American Gas Assn.
j: Fans and Blowers	Bulletin 110	Air Moving and Conditioning Assn.

	REFERENCE	PUBLICATION	AUTHORITY
k:	Electrical Equipment, Heating Equipment, Controls and Motors	Regulations Nat. Electrical Code (NFPA #71)	Minn. Electrical Board, National Board of Fire Underwriters and The Nat. Elec. Mfg. Assn.
l:	Oil Burners	CS-75-56 NFPA #31, Oil Burning Equipment	Nat. Bureau of Standards & U.S. Dept. of Commerce, Nat. Fire Protect. Assn.
m:	Heat Pumps and Refrigeration Compressors	Standards 10-57	ASHRAE. ASRE, Air Conditioning and Refrigeration Institute
n:	Accident Prevention: Electrical and Heating Equipment, Boiler Room	Safety Standards, Codes Regulations; Prevention of Accidents, Preservation of Health in All Places of Employment	Minnesota Industrial Commission

Section

234.0 TYPES OF HEATING AND VENTILATING SYSTEMS

234.1 Direct Radiation Heating. Accomplished by installing radiators or convectors in areas to be heated.

234.2 Unit Ventilator System. Consists of the use of individual unit ventilator units in each room requiring heating and/or ventilation, the unit having a heating system (steam, hot water, or electric), fan, filter, and a method of regulating the amounts of outside and recirculated air.

Note: Direct fired unit ventilators or heating equipment should not be applied to the occupied spaces of school buildings.

234.3 Central Forced Air System. This system consists of one unit serving all or a group of rooms requiring heating and/or ventilation, the unit having heating coils, fan, filter, and a method of regulating the amount of outside and recirculated air. The system forces the conditioned air by fans through ducts to the rooms.

234.4 Split System. This system combines the forced air system with room radiation heating. Usually room radiation heating is used to supplement the forced air system.

234.5 Panel (Radiant) Heating. A radiant heating system of any type. This system produces a radiant temperature and warms the room by means of floor, ceiling, or wall which is heated above room temperature by imbedded hot water (or anti-freeze) piping, warm air ducts, or electric heaters. Ventilation and cooling are accomplished by mechanical means or by open windows. A supplementary source of heat usually is necessary in panel heating systems to offset the excessive cooling effect of ventilation. Heat is distributed by convection as the air passes over the warm air panel and by radiation direct from the source to the object.

234.6 Warm Air System, Direct Fired. Consists of a furnace located outside the area served which heats air and by a fan and a network of ducts circulates the heated and filtered air to one or more rooms. Ventilating air is heated and circulated in the same manner.

235.0 TYPES OF HEATING CONTROLS. Adequate and automatic temperature controls are essential. Automatic controls for heating and ventilating systems for schools may be:

a. Individual room controls which relate the output of the system in each room to the needs of the room.

b. Zone controls, in which a group of rooms, preferably with a common orientation, are controlled by a single thermostat located somewhere in the zone.

c. Day controls which are concerned with the operation of the system during occupied day periods.

d. Night controls which reduce the temperature of the building during the shut-down period.

e. Day-night controls which permit the selective restoration of individual rooms or a group of rooms to day control at night by means of a push button on the thermostat.

In addition there are boiler, furnace, and burner controls which permit automatic firing of the heating plant.

Automatic control may be electric, usually employing low voltage electric wiring to transmit the control signals, or pneumatic, which employs compressed air in pipe lines, or electronic devices.

236.0 SELECTION OF SYSTEMS

236.1 General. The selection of the heating and ventilating system should be made with special consideration for economy of operation, flexibility of control, quietness of operation, and for its capacity to provide an adequate thermal environment during the school year. If the building is not a complete unit, consideration should be given to the need and plan for future extension.

236.2 Basic Objectives. Every heating and ventilating system should:

(1) Maintain room temperatures sufficient to balance the heat losses from the body by radiation, convection, evaporation, and by exfiltration from the room.
(2) Remove excess heat and dilute and remove unpleasant body odors and other odors.
(3) Diffuse conditioned air without stratification or drafts.
(4) In special cases remove hazardous gases, vapors, fumes, and dusts.
(5) Maintain floor slab temperatures and temperatures of other surrounding surfaces at levels conducive to good physical comfort.

Section

237.0 PLANS AND SPECIFICATIONS

237.1 Drawings. The drawings should include the heating, ventilating and air conditioning to be provided for each room and the size of the grilles, registers, pipes, ducts, etc.

237.2 Specifications. The specifications should include a brief, clear description of the system—as non-technical as possible.

238.0 PERFORMANCE TESTS

238.1 Upon completion of the installation of the heating, ventilating and/or air conditioning system in a school building, performance tests of the system and its parts should be conducted by the contractor and be reviewed by the mechanical engineer who designed the system or his qualified representative.

238.2 The required tests should include the following:

a. Operating tests of the entire system during cold weather with proper adjustment for non-standard conditions.

b. Performance tests of the ventilating system or systems with measurement of air flow through all supply and return grilles after proper balancing.

c. Measurement of capacity of all individual exhaust and supply fans.

d. Measurement of air flow of designated unit ventilators of each different size and check of general mechanical operation of ventilators.

238.3 Those tests which can be performed should be made immediately. Those tests which must be deferred should be scheduled for the future when the weather is suitable.

238.4 If the mechanical engineer finds that specification requirements are not fully met, he should notify the contractor to do what is necessary to satisfy the specifications and plans. The engineer upon notice from the contractor should then observe final tests and following satisfactory completion of the tests he should then notify the school board that the results of the tests are satisfactory.

239.0 MANUAL OF INSTRUCTIONS FOR MECHANICAL SYSTEM. It is recommended that the mechanical engineer be commissioned to prepare and provide a manual of operating and maintenance instructions having the following general contents:

Chapter I. General Description
- A. Manual and Its Use
- B. Heating System
- C. Ventilating and/or Air Conditioning System

Chapter II. Plant Operation
- A. Starting the Heating Plant

Section
- B. Operation Schedule—Heating
- C. Operation Schedule—Ventilating and/or Air Conditioning
- D. End of Season Shut-down

Chapter III. Maintenance
- A. Maintenance and Lubrication Chart
- B. Valve and System Chart

Chapter IV. Manufacturer's Literature—The items of equipment and literature to be listed will depend on the type of heating and ventilating and/or air conditioning systems.

Chapter V. Shop Drawings—The items for which shop drawings are to be provided will depend upon the types of heating and ventilating and/or air conditioning systems used.

Note: For detailed description of Manual of Instructions and illustrations for three buildings, see: "Mechanical-Electrical Equipment Handbook for School Buildings." Terry Harry, John Wiley and Sons Inc., New York, New York. 1960. pp. 85–116.

240.0 DESIGN TEMPERATURES

240.1 Basis for Heating Calculations

a. Reference should be made to the latest outdoor winter design temperature isotherm maps and tables to be found in the ASHRAE Guide.

b. Capacity of the heating plant should be figured after study of the past weather experience of the locality, considering the low temperature over the past years, severity of exposure to cold winds offered by the site, and structural materials and insulation to be used in the building.

c. Reserve heating capacity should be provided for heat pick-up, heat losses, and allowances for introduction of required outside air for ventilation. If not a complete building unit, additional capacity for future expansion of the building should be considered carefully.

240.2 Design Temperatures During the Heating Season

a. Heating and ventilating facilities should be so designed that when properly installed and operated with the thermostats in all spaces set as indicated in Table 241.1, there is thermal and atmospheric comfort.

b. The maximum air temperature gradient from floor to 60 inches above the floor should not generally exceed 5 degrees and preferably not exceed 3 degrees.

c. Reduced temperatures for night and week-end periods are recommended. Recommended night setting is 60 degrees.

d. Systems should incorporate some means of providing reasonably quick morning pick-up capacity.

e. Due to increased condensation effect on cooler room surfaces, temperatures in swimming pool areas should be maintained at a constant setting.

240.3 CLIMATE CONTROL DURING THE NON-HEATING SEASON

a. Since extensive use of school buildings during the summer months appears increasingly in evidence, the installation of systems for effective climate control for year around use is recommended. When such a system is installed control of temperatures within ranges of 72 to 78 degrees and relative humidity within ranges of 40 to 60 percent are necessary.

b. When a building is insulated and air conditioned, using electrostatic filters or similar filter devices, the ratio of outside air to total air circulated may be reduced to a fixed general minimum of 15 percent in those spaces where a requirement of 25 percent outside air is indicated in Table 241.1.

241.0 HEATING AND VENTILATING CONDITIONS. Recommended heating and ventilating conditions for major occupied areas of school buildings are stated in Table 241.1 following.

241.1 TABLE: HEATING AND VENTILATING CONDITIONS FOR MAJOR OCCUPIED AREAS

Heating		VENTILATION		
Temp. at Thermostat[1]	Occupied Areas	Recommended Air Changes Per Hour	Minimum Outside Air—(OA)	Exhaust Air
72°	Classrooms: normal occupancy—30 pupils	30 cfm per pupil	7½ cfm per pupil	7½ cfm per pupil; separate exhaust if no windows
72°	Auditoriums: 7 sq. ft. of floor area per occupant	4–6	5 cfm per occupant	5 cfm per occupant
72°	Board Rooms	6	25% OA	25% exhaust
	Where smoking	15		
70°	Kitchens (cafeteria)	20	As required. See Cafeterias	10% more than cafeteria OA
72°	Cafeterias	6	25% OA or as requ. to satisfy 90% of kitchen exhaust	
65°	Dry Food Storage	3–5	—	Gravity or mechan.
74°	General Office	6	25%OA	
65°	Gymn. for phy. ed. classes	3	25% OA[2]	10% more than OA[3]
	Games and assemblies	6	25% OA[2]	10% more than OA[3]
72°	Home Ec.: Clothing	6	25% OA	
70°	Foods: Lecture	6	25% OA	
70°	Cooking	8	100% OA	110% exhaust;[6] control in room
72°	Laboratories: art, biology, chemistry or multi-purpose science labs.			
	Lecture	30 cfm/p	7½ cfm/p	7½% cfm/p
	Laboratory experi.	8–10	100% OA	110% exhaust; room control or switch[6]
70°	Laundries	10–20	100% OA	110% exhaust[6]
72°	Libraries	6	7½% cfm/p	7½% cfm/p
80°	Locker rooms	20	100% OA or gym. relief air in proper volume	Total exhaust all spaces to be 10% more than OA supplied directly or to gym
80°	Shower rooms	8–10		
80°	Basket and suit drying room.	8–10		

241.1 Table: Heating and Ventilating Conditions for Major Occupied Areas

Heating		VENTILATION		
Temp. at Thermostat[1]	Occupied Areas	Recommended Air Changes Per Hour	Minimum Outside Air—(OA)	Exhaust Air
72°	Lounge rooms	6–10	25% OA[4]	Where smoking, 100% exhaust
72°	Teachers work rooms	6–10	25% OA[4]	
70°	Music rooms	6	25% OA as requ. for practice room exh.	
70°	Practice rooms	10	See above	10% more than music room OA
70°	Playrooms or multipurpose rooms, element	6	25% OA	10% more than OA
70°	Shops:			
	Agriculture	4	50% OA	10% more than OA, incl. CO exhaust system
	Auto: motor repair	6	50% OA	10% more than OA, incl. CO exhaust system or to satisfy exhaust requirement.
	Metal	6	25% OA[4]	10% more than OA
	Wood	6	25% OA[4]	10% more than OA
	Vocational trade shops[5]	(Requires system designed for type of Shop)		
72°	Study halls	30 cfm per study station	7½ cfm/p	7½ cfm/p
80°	Swimming pools: Design will depend on exposure and construction	Special problem	100% OA	110% exhaust[6]
70°	Toilets	10–20	—	100% exhaust

---

[1] It is not practical to establish a temperature design at any height but the thermostat level.

[2] Suggested as ample minimum.

[3] Toilet room and/or locker room exhaust, when such rooms are connected to and can be used in conjunction with either gymnasium or auditorium, may be used in lieu of a separate exhaust fan if such exhaust volume meets the minimum requirement.

[4] May require more than 25% in some cases.

[5] Approval of ventilation design will be made upon examination of individual plans and specifications, and in the case of vocational shops, based upon the requirements of the State Industrial Commission.

[6] Caution should be exercised in the indiscriminate use of the 110% exhaust rule, since the cumulative effect could cause a serious and undesirable negative pressure on the building.

Section

241.2 Artificial Cooling. Where artificial cooling is employed, the air capacity should be as required for the cooling load but in no case be less than the recommendations as stated in Table 241.1.

241.3 Wardrobes, Coat Rooms, Locker Alcoves, Lockers

a. All wardrobes and coat rooms in or adjacent to classrooms and all locker alcoves in classrooms or corridors should be provided with mechanical ventilation or ventilated by means of classroom relief air carried thru these spaces.

b. When wardrobes and coat rooms in or adjacent to classrooms are ventilated by classroom relief air, the location of the vent outlets should be such as to insure venting of the classrooms from the floor level and avoid short-circuiting the air through the coat room.

Section

c. Where separate vents to roof are installed from coat rooms and wardrobes, the air movement from these areas should be not less than 2 cubic feet per minute per square foot of floor area.

241.4 Corridors

a. Air from occupied area, other than gymnasiums and auditoriums, uncontaminated by other than human occupancy may be relieved into corridors and the corridors relieved or exhausted through auxiliary spaces such as lockers, toilet rooms, etc., provided that sufficient additional relief from the corridor space be provided through the roof of the building to furnish an aggregate total relief and exhaust capacity approximating the total outside air volume of the supply systems in these areas.

b. In multiple story buildings with enclosed stair wells, the corridors of each floor must be relieved or exhausted.

c. In case of buildings with open stair wells, the corridor space may be relieved or exhausted from the top story.

241.5 Equipment Drying Rooms. Rooms used for drying athletic uniforms and football gear should be so heated and ventilated that uniforms and gear will be thoroughly aerated and will be dry in 24 hours.

241.6 Swimming Rooms. Ventilation design will depend on room exposure and construction materials. Approval of design will be based upon examination of each plan and specification.

Note: If the ceiling is directly below a roof, an air space should be provided between the roof and ceiling through which warm air is circulated to prevent condensation.

242.0 BOILER ROOMS AND HEATING EQUIPMENT ROOMS

242.1 Size

242.11 General. All boiler and furnace rooms should be of ample size to permit installation of original equipment and anticipated alterations and additions to the building.

242.12 Servicing. Adequate space should be provided for servicing and cleaning the equipment, access to the chimney clean-out, and for the replacement of boiler tubes.

242.2 Location. See Section 123.1" Fire and Life Safety."

242.3 Construction, Blast Control. See Section 123.22.

242.4 Replacement Panel. A removable wall panel, window, or large door should be provided in the outside wall of each boiler room of size ample for the removal or replacement of any equipment installed within, or anticipated future equipment.

242.5 Combustion Air. Each boiler or furnace room shall be provided with an outside air supply sufficient to support efficient combustion or fuel burned per criteria presented in the ASHRAE Guide.

a. Additional gravity or natural ventilation is recommended where possible by operating windows and louvers.

b. Care should be taken that any door opening to the boiler room does not cause air to be drawn from the fuel burning equipment.

242.6 Chimneys and Flues. Where mechanical drafts permit low stacks, the heights and locations should be carefully considered so that they will not be so close to fresh air intakes as to cause difficulty under certain barometric conditions or prevailing wind directions.

242.63 Draft Control

a. Coal Burning Equipment. Hand fired coal burners and stoker installations should have some means of draft regulation.

b. Oil Burning Equipment. The breeching or flue for all oil burning equipment should be provided with a barometric damper or automatic draft regulator.

c. Gas Burning Equipment. An approved hood or backup draft device should be provided for gas burning equipment unless unit is equipped with a mechanical draft inducer.

242.7 Access from Pupil Occupied Space. Access to the boiler or furnace room should be made through two doors or a door (Class B Fire Doors) recessed in an angled vestibule. Doors should swing toward the boiler room.

243.0 FUEL STORAGE AND HANDLING

243.1 Oil Storage. Liquid fuel storage for central heating systems should be provided in Underwriters approved metal tanks, installed in accordance with NBFU Standard No. 30, and meeting all the requirements of the State Fire Marshal's Office.

243.11 Tank Capacity. The tank capacity for liquid fuel should be based on a minimum of the fuel requirements for January or about one-fifth of the heating season. In no case should the tank be smaller than required for buying the fuel in truck transport lots.

243.2 LP Gas. Where liquified petroleum gases are used for fuel, the storage and handling must comply with the Minnesota Fire Marshal's Rules and Regulations covering the handling, storage, and transportation of LP gas.

243.3 Building Gas Service. Where gaseous fuel is used, the building gas service mains shall be routed so that they do not pass through or under any part of the school building, unless encased and vented to the outside on one or both ends.

243.31 The building gas service main on the school property should be sized for any anticipated building addition.

243.32 Outside Shut-Off Valve. An outside shut-off valve should be installed on the building gas service main, preferably more than 15′ from the building. The valve is to be accessible and plainly marked "Main Gas Valve."

244.0 FIRING EQUIPMENT AND CONTROLS

244.1 Boilers and Unfired Pressure Vessels

244.11 Code and Standard Requirements. The design, construction, equipment, connections, controls, etc., of all boilers and unfired pressure vessels must meet the ASME codes adopted by the Division of Boiler Inspection, Minnesota Department of Labor and Industry, and the Safety Standards of the Industrial Commission of Minnesota. See Section 233.0 References for Design Standards.

244.12 Rating. All heating boilers should be of capacities in accordance with the Net Load Recommendations for Heating Boilers issued by the Heating, Piping and Air Conditioning Contractor's National Association, or the Steel Boiler Institute, or the Institute of Boiler and Radiator Manufacturers.

Section

244.2 BURNER CONTROLS. The operation of the firing units for all central heating systems, including oil burners, gas burners, and stokers, should be controlled automatically by the demand for heat, either directly or indirectly, through the automatic control of the heating medium.

244.3 SAFETY DEVICES ON FIRING EQUIPMENT

244.31 Flame Failure. Oil and gas fired equipment should be provided with manually reset flame-failure safety cut-out devices, preferably of electronic type.

244.32 Overheating. Boiler burner and furnace burner controls should include over-heating and over-pressure safety devices and all other controls required for boilers and furnaces.

244.4 FURNACES: FORCED WARM AIR SYSTEM

244.41 General. Direct fired warm air heating systems may be used in new school buildings. It is recommended that the use of such systems be restricted to school buildings designed for not more than five classrooms.

Gas fired classroom units are not recommended. If used, they must be enclosed in fire-rated enclosures. See 244.5.

Gravity warm air furnaces will not be recommended for school buildings.

244.42 Design Ratings

a. Oil or solid fired warm air furnaces should be rated in accordance with the Code for Testing and Rating of Furnaces of the National Warm Air Heating and Air Conditioning Association.

b. Gas fired furnaces should be rated in accordance with the Code for Testing and Rating of Gas Fired Furnaces of the American Gas Association.

c. All fans used for warm air systems should be constructed of the physical proportions of commercial fans and rated in compliance with requirements and standard test codes of the Air Moving and Conditioning Association (AMCA).

244.43 Installation Standards, Forced Warm Air Systems

a. Direct fired, forced warm air systems should be installed with the applicable standards of the National Board of Fire Underwriters: (1) the Installation of Air Conditioning and Ventilating Systems of Other than Residence Type, NBFU Pamphlet No. 90A; (2) the Installation of Residence Type Warm Air Heating and Air Conditioning Systems, NBFU Pamphlet No. 90B; (3) the Installation of Oil Burning Equipment, NBFU Pamphlet No. 31.

b. The use of a by-pass duct and damper control with continuous air circulation is recommended for occupancy periods with "night" shut down provisions for an operation only in response to space temperature requirements.

244.44 Safety Devices, Forced Warm Air Systems

a. All automatically fired oil and gas equipment should be provided with reset flame-failure safety cut out devices.

b. In systems utilizing re-circulation, serving more than one story of a building, or more than one fire section of a single story, fans should be arranged to shut down automatically when the temperature of the air in the system becomes excessive, as from fire. For this purpose an approved thermostatic device, with a setting not in excess of 125 degrees F. should be located in the system at a suitable point in the return air duct ahead of the fresh air intake. See NBFU Pamphlet No. 90A, Section 172.

c. Combustion safeguard and combustion safeguard equipment should be provided in compliance with the applicable standards contained in NBFU Pamphlets: No. 90A, No. 90B, and No. 31.

d. It is recommended that temperature control for forced warm air systems be accomplished by control of the heater or preferably, for by-pass systems, by the regulation of the air quantity through the heater and by-pass. Multiple zones of face and by-pass control should be provided as required by the nature of the building exposure.

244.5 DIRECT FIRED GAS CLASSROOM HEATING AND VENTILATING SYSTEMS. (State Fire Marshal's Conditions). Individualized heating and ventilating systems designed to heat and ventilate one or two classrooms or similar instructional facilities will be considered for approval under the following conditions:

a. Provide sufficient heating capacity to heat the facility adequately and sufficiently under standard Minnesota area design temperatures.

b. Circulate approximately 30 cfm per occupant of which 7½ cfm is outside air.

c. The heat exchanger to be located within a room having a two-hour fire resistant reinforced wall.

d. The heat room to have one door leading to the outside on the exterior wall, this wall to be reinforced and of light construction. The heater room to have an outlet to the outside at floor level to permit heavy gases to escape.

e. The heater room to have a combustion air supply, and an approved vent or chimney leading up through the roof for venting products of combustion. The heater room to be of sufficient size to provide at least 15 inches side clearance and 20 inches frontal clearance.

f. Each classroom to have individual thermostatic control. Mechanical regulation to provide 100% recirculation of air during the night and during the warm-up period permit 25% outside air intake during normal operation and to increase outside air intake to 100% for cooling purposes.

g. The installation to meet all state and local code requirements, also, applicable national standards (NBFU).

h. Gas Equipment to meet American Gas Association approval.

These installations will be considered for approval in elementary schools of one story design.

245.0 PIPING, STEAM AND HOT WATER

245.1 PIPE SIZES AND ARRANGEMENT. All steam and hot water supply and return piping and auxiliary equipment should be of appropriate size, elevation and arrangements in accordance with standard engineering practice to accomplish the calculated service in practical operations without undue noise, stress, or other detriment. They should be adequately shown on plans submitted for approval.

245.2 Expansion and Contraction. Appropriate anchors, expansion swings or joints, supports and other trade essentials should be provided in every piping system.

245.3 Exposed Pipes and Ducts. Exposed pipes and ducts should be avoided in all occupied spaces. If exposed hot piping is unavoidable, it should be adequately insulated.

245.4 Hot Water Panel Heating Systems. Recommended maximum average surface temperature:

Wall	Ceiling	Floor	Perimeter Bank
120°F.	120°F.	85°F.	105°F.

The perimeter strip of floor panel heating systems should not exceed 18″ wide measured from the outside wall.

245.41 Panel Temperature Control. Individual room control (highly desirable) or a separate zone control for each zone of different exposure (room orientation), should be provided. Zones should not include more than one floor of a multi-storied building.

245.42 Panel Water Temperature Control. The water temperature should be automatically controlled in inverse proportion to the outside temperature.

246.0 HEATING UNITS

246.1 Radiators and Convectors. Radiators, convector units and continuous fin-tube convectors should be:

a. Generally located under windows or points of greatest exposure.

b. Mounted to clear the floor at least four inches, if wall hung.

c. Provided with shields or housing designed to protect pupils from tubes, make cleaning easy, and increase convection.

e. Recessed or mounted at least 7′ high to bottom in places of assembly, playroom or assembly.

f. Mounted to project not more than 8″ from the wall when placed in corridors.

246.2 Unit Ventilators

246.21 Size and Capacity. The size and heating coil capacity of unit ventilators should be such as to maintain design room temperature and total required minimum outside air for the space under outside design temperature conditions.

246.22 Control Cycle. The control cycle of unit ventilators should be such as to:

a. Close the outside dampers during the heating up period.

b. Keep the dampers closed during the "night" sh[illegible] down period.

c. Admit during normal operation, when spaces are occupied, the recommended minimum amount of outside air for ventilation which will be automatically increased as needed for cooling.

246.23 Circulation. Unit ventilators should have controlled outside air and recirculated air connections of approved design, and air discharge vanes, louvers, or grilles that will direct the air in the proper direction to prevent objectionable drafts.

246.24 Temperature Control for Unit Ventilators. One or more unit ventilators in a single room should be controlled from a room thermostat.

246.3 Unit Heaters. Propeller type unit heaters should be used only where the noise level and air blast is compatible with the use of space. Unit heaters should be equipped with steam, hot water, or electric heating elements only. Blower type unit heaters should be selected for quiet operation.

246.31 Temperature Control for Unit Heaters. One or more unit heaters in a single space should be controlled by a room thermostat, or a thermostat should be provided for each unit heater.

246.4 Electric Panel Heating Elements. Panels should be located on walls and ceiling and limited to the temperatures listed under Hot Water Panel Heating Systems, Section 245.4. Electric panels should be on circuits with no other outlets.

246.41 Electric Panel Temperature Control. Individual room temperature (preferred) or a separate zone control should be provided for each zone of different exposure (room orientation).

247.0 CENTRAL FAN, HEAT PUMP AND AIR CONDITIONING SYSTEMS

247.1 Central Fan System and Controls. Supply systems for ventilation and/or heating should be provided with steam, hot water, or electrical heating media under thermostatic control. Auxiliary controls should be included where more than one zone is served.

247.2 Heat Pump and Air Conditioning Systems. Installations, serving one or more rooms, should in general conform to the recommendations of sections 230–259 and the ASHRAE Guide.

247.21 Controls. A complete description of the controls and sequence of operations should be contained in the specifications submitted for approval.

248.0 TEMPERATURE CONTROLS

248.1 General

a. All temperature controls, including zoning controls and thermostats should be designed and located to maintain not less than the temperatures listed in Table 241.1 with the ventilation recommended in the space during the school session.

b. It is recommended that room thermostats be installed in all heated rooms.

c. Special spaces such as gymnasiums, auditoriums, shops, and other large areas should be provided with special control design, depending upon the type of heating and ventilating equipment selected.

d. See also the following references:

Furnaces: Forced Warm Air . .	Sec. 244.44 d.
Direct fired gas classroom heating units	Sec. 244.5 f.
Panel heating controls	Sec. 245.41; 245.42
Unit ventilator controls	Sec. 246.22; 246.24
Unit heater controls	Sec. 246.31
Central fan system	Sec. 247.1
Heat pump and air conditioning	Sec. 247.21

248.2 LOCATIONS, ZONE CONTROL. The administration unit, auditoriums, gymnasiums, lunchrooms, the vocational education unit containing agriculture, business, distributive, home economics, and industrial education departments, and other parts of the building that may be used outside of regular school hours should be so zoned that their heating and ventilating facilities may be operated and controlled independently of the rest of the building.

248.3 ELECTRIC HEAT CONTROL. Each room or space in which electric resistance heat is a main or supplemental source of heat should have a room thermostat controlling the electric elements in response to the heat demand.

248.4 THERMOSTATS

a. Thermostats located in spaces occupied by pupils, teachers, and the public should be locking type. Those in gymnasiums, locker rooms, shops, toilets, corridors and other areas where the instruments are subject to mechanical damage should also be protected with guards. Ordinarily, thermostats are mounted not more than 5 feet high. In some spaces they may be placed about 6 feet high to avoid tampering by pupils.

b. Dual or "day and night" thermostats are recommended for fuel economy.

248.5 INDICATOR PANELS. Consideration may be given to the installation of an indicator panel and control center in each building which will include an approved means of indicating the location and operating condition of significant, remote heating and ventilating equipment. Most adjustments in heating and cooling can be made from the control center.

The panel may be located in the administrative office, custodian's room, or other approved location, accessible only to the responsible personnel charged with plant operation and maintenance. See 110.23.

249.0 THERMAL COMFORT AND EFFECTIVE TEACHING

a. The teacher should be informed that studies have indicated that younger people are at their maximum attentiveness in the classroom where temperature is maintained two or three degrees less than most adults consider suitable for their personal comfort. Therefore, teachers should dress warmer than pupils for maximum teaching and learning achievements.

b. Since overheating makes pupils drowsy, inattentive, and difficult to instruct the teacher should be alert to:

(1) Adjusting window shades or other direct sunlight controls so as to admit only the necessary amounts of sunlight and heat.

(2) Scheduling light activities for early afternoon classes so that pupils can easily dissipate the additional body heat from a warm lunch and exercise.

(3) Informing parents as to what is proper clothing for pupils working in the classroom at "normal" temperature.

250.0 VENTILATION DESIGN, GENERAL

250.1 OUTSIDE AIR SUPPLY, SOURCE. The outside air should be taken from an uncontaminated source outside the building.

250.2 OUTSIDE AIR INTAKES

250.21 Location. All outside air intakes should be located as far as possible from the top of chimney and vent outlets.

250.22 Height Above Grade. Fresh air intakes for central systems should preferably be located with the bottom of the opening at least 3 feet above grade and/or 3 feet above an adjoining roof. Fresh air intakes should be designed to allow the system to deliver 100 percent outside air in the milder weather.

250.23 Screens. All outside air intakes should be protected against the admission of foreign material with a ½ inch mesh screen or equal. Provide a means of access to the screen for cleaning.

250.24 Weather Protection. All outside air intakes should be protected against weather and water with a weatherproof hood or louvers of ample free area designed to limit entering velocities to 500 feet per minute under maximum outside air conditions.

250.25 Accessibility and Cleanliness. All outside air intakes should be made and maintained easily accessible for cleaning and should be kept clean and sanitary in use throughout the circuit to the heating and ventilating units.

250.26 Intakes for Combustion. All boiler room or furnace rooms should be provided with outside air supply sufficient to support efficient combustion of fuel burned per criteria stated in the ASHRAE Guide.

250.27 Incinerator Rooms. Any room containing an incinerator should have a separate manually or automatically operated combustion air intake of proper size. When the incinerator is located in a boiler or furnace room, the boiler or furnace intake may be sized for the total aggregate combustion air requirements of the boiler or furnace and incinerator, but provision should be made for manually or automatically opening and closing such intake during times that the incinerator is in use. Provision may be made for locking such intake damper open, but no locking device should be employed for keeping the damper closed.

Section

250.3 AIR CLEANING DEVICES

250.31 Standard. Approved air cleaning devices should be installed in connection with all heating and ventilating systems. This applies to both outside and recirculated air.

NOTE: When recirculated air is drawn through charcoal and lithium bromide filters, the required outside air intake may be substantially reduced.

250.32 Design. The construction, design, and control of all air cleaning apparatus should be such as to insure ease of maintenance and consistent operation. All filters should be arranged so as to be easily accessible for cleaning and inspection service.

250.4 FANS AND BLOWERS

250.41 Type and Capacity. All fans and blowers should be of appropriate type and capacity and be selected upon the basis of performance against the resistance of the system as installed. All fans should be rated in accordance with the latest standards and test requirements for fans and blowers as adopted by the American Society of Heating, Refrigeration, and Air Conditioning Engineers or the Air Moving and Conditioning Association. (AMCA).

250.42 Quiet Operation. Fans and blowers should be located and set, and be of such type and outlet variety in practical use, that reasonably quiet operation is assured.

250.43 Equipment Rating. The air capacity of all equipment supplying air for heating, ventilating, and air conditioning should be based upon Standard Air ratings.

250.5 AIR QUANTITY. The quantity of air used to ventilate a given space during occupancy should always be sufficient to maintain standards of air temperature, air quality, air motion, and air distribution as recommended by this manual.

250.51 Air Changes and OA. Recommended air changes and minimum outside air are given in Table 241.1.

250.52 Recirculated Air. No air contaminated by other than human occupancy should be used for recirculation. Systems employing partial recirculation should be designed and positively controlled so as always to admit not less than the required minimum of outside air except during the unoccupied or heating-up period. Such systems should be arranged so as to permit taking the entire volume of air from outside when necessary for cooling purposes.

250.53 Tempered Air. Tempered air supply should be provided by either mechanical supply systems or induced by mechanical or gravity exhaust in spaces where there are four or more air changes per hour. This does not mean that all outside air should always be heated to room temperature upon entering, as cool air will be needed intermittently for cooling. The heating element should be designed to temper the air and should be thermostatically controlled, preferably by a modulating control in response to the room temperature.

Large spaces such as gymnasiums, shops, and dining rooms are economical sources of tempered air for their auxiliary facilities or exhaust systems, i.e., gymnasium air may be relieved and exhausted through locker and shower rooms; shop air through paint spray booths, and dining room air through kitchen.

Section

250.6 MAXIMUM ROOM INLET TEMPERATURE. The calculated room inlet temperature of air used for ventilating and heating purposes should not exceed 130 degrees F. at register.

250.7 AIR VELOCITIES IN CLASSROOMS. Air velocities in the occupied zone of 25 to 35 fpm are desirable, but of 20 to 50 fpm are acceptable.

250.8 OUTLETS AND RETURNS

250.81 Number and Location. The capacity, number and location of outlets, returns, and exhaust should be such as to insure a uniform distribution of air throughout the areas served, without objectionable drafts, and so that the air will not be short-circuited from the supply to the exhaust opening.

250.82 Location on Plans. The location of all room outlets, returns and exhausts, as well as the location of the outside air supply, should be shown on the plans.

250.83 Registers, Diffusers, Grilles. All supply outlets should be equipped with registers, diffusers or grilles which will provide a uniform distribution of air.

250.84 Limitation on Location. Registers or grilles in floors will not be approved.

250.85 Sound Transmission. Supply and exhaust outlets should be designed and arranged in occupied areas in such position that objectionable sounds will not be transmitted through the ducts or outlets to other occupied spaces.

250.9 AUTOMATIC CONTROLS. Automatic controls should be provided, maintained, and operated for all heating and ventilating equipment.

250.91 Zone Ventilation Control. Rooms or units of the building to be used outside of regular school hours should be zoned for heating and ventilating independently.

250.92 Hood Fan Controls. All hood fans should have separate control, accessible to persons using the hood.

251.0 DUCTS, DAMPERS, AND VENT DUCT TERMINATION

251.1 GENERAL. All duct systems should be designed in accordance with the recommendations of the ASHRAE Guide and approved engineering practice.

251.2 MATERIALS FOR DUCTS. All ducts, plenums and unoccupied spaces used to conduct ventilation air should be constructed of non-flammable materials, and any interior lining should be non-flammable.

251.21 Ventilation Ducts. Sheet metal ducts are preferred, but when other materials are used an allowance should be made for the increased coefficient of friction which is of major importance in mechanical systems employing appreciable air velocity.

Section

251.22 High Velocity Ducts. Heavy gauges of sheet metal should be used. The ducts should be round or heavily reinforced. Welded oval ducts may be used providing the short dimension is no less than one-half the long dimension.

251.23 High Humidity Exhaust Ducts. All ducts and hoods which conduct high humidity air such as dishwash air should be moisture resistant, of galvanized or preferably copper or aluminum sheet metal, or stainless steel, with soldered joints. Welded joints are acceptable if the material lends itself to reliable welds.

251.3 DUCT INSULATION. Warm air supply ducts which are in unheated areas should be insulated. Air conditioning supply ducts and return ducts which are in unconditioned areas should be insulated and provided with a vapor barrier. When air conditioning ducts are lined with insulation, the sheet metal duct may be construed a vapor barrier, providing all mechanical joints and seams are sealed with a vapor barrier tape or adhesive.

251.4 VOLUME DAMPERS AND DEFLECTORS. Necessary volume dampers, splitters, and deflectors should be provided for all ducts to permit accurate balancing of the system, and such dampers, splitters, and deflectors, should be set according to air movements of the system and then be locked in place. They should always be easily accessible for readjustment.

251.5 BACKDRAFT DAMPERS. Where dampers are installed in gravity vent ducts, automatic backdraft dampers should be used. Backdraft dampers may be used for mechanical exhaust but should not be used in an exhaust system handling moist air or grease-laden air such as in the case of dishwasher and range hood exhausts.

251.6 FIRE DAMPERS. All ducts must be provided with fire dampers where required by the Fire Marshal's regulations.

251.7 TERMINATION OF VENT DUCTS

251.71 Roof Exhaust Openings. Final delivery of all vent circuits should be protected from the weather and against backdrafts by approved devices and should be so located and constructed as to prevent contamination of air supply for or in any occupied area.

251.72 Gravity Ventilator Heads. Gravity vent ducts should extend not less than 2 feet above the high portion of the roof or parapet wall, and should be surmounted with a type of roof ventilator tested as to capacity ratings and certified as weatherproof by a recognized testing authority.

252.0 EXHAUST SYSTEMS

252.1 SEPARATE EXHAUST SYSTEMS. Exhaust systems serving main toilet rooms, physical education or athletic rooms, shower rooms, swimming rooms, lunchroom kitchens, home economics kitchens, laboratories or shops with air contamination, smoking rooms, laundries, and permanent projection rooms should be separate and independent from each other and all general exahust systems in the building.

252.11 Single Toilet Rooms. When not provided with a window on an external wall, single toilet rooms must be provided with exhaust ventilation (Minnesota Plumbing Code, Sec. 100).

Recommendation: All toilet rooms should be exhausted whether single or not.

252.2 LOCAL MECHANICAL EXHAUSTS

NOTE: The Minnesota State Industrial Commission requires that any device or apparatus used in laboratories or shops producing intense heat, odors, fumes, spray, gas, smoke or any other air contamination or hazard in such quantities as to be irritating or injurious to health shall be equipped with a local mechanical exhaust which in all cases must comply with the requirements of the Commission.

252.3 FUME HOODS. Chemical fume hoods must be provided with mechanical exhaust; but several hoods may be connected to the same duct system if they are to be operated as a group.

NOTE: Fume hoods should be installed in senior high school and junior college unit chemistry laboratories. For the multipurpose science room, infrequency of use of hoods and use of semi-micro techniques may eliminate the use for them. Some schools provide a small downdraft hood on the instructor's demonstration table or on one or two student tables.

Chemical Hood Exhaust Ducts. Acid resisting materials should be used and ducts should be made water tight to prevent condensed acid vapors from leaking out of the duct. Fan interiors should be coated with an approved acid resisting material or the fan itself should be constructed of acid resisting materials.

252.4 KITCHEN SYSTEMS

a. Kitchen cooking equipment in lunchrooms, including ranges, ovens, steamers, and steam kettles should be provided with hoods or other types of mechanical exhaust ventilation. Adequate filters or grease traps should be provided on all range canopies, with provision for cleaning and servicing.

b. Dishwashing rooms should be provided with mechanical exhaust.

252.41 Kitchen Hoods

DESIGN. Kitchen canopy type hoods should have mechanical exhaust providing a minimum velocity of 100 fpm. over the face of the hood. For double hoods, the velocity over the area between the inner and outer hoods should approximate 500 to 800 feet per minute, using a 2-inch slot as a base.

DUCTS. Heavy gauges of sheet metal (not less than 18 gauge) or other noncombustible material should be used. All range hood ducts should be welded.

252.5 PAINT SPRAY BOOTHS. Must have mechanical ventilation. Minnesota State Industrial Commission requirements are as follows: (Code: Sec. #8886 page 201).

"VENTILATION. Ventilation must be of sufficient capacity to assure an air travel past the breathing area of the employee (or pupil) of 100 lineal feet per minute or more. Exhaust openings must be either in the floor or walls and the center of the opening cannot be more than four feet above the floor level. Air intake openings, with filters,

Section

shall be placed in booth ceiling for a floor level exhaust, or in upper half of opposite end of booth from wall mounted exhausts. Motor driven exhaust fans must not be located within the duct, and may drive the fan either by an enclosed belt or shaft extended through an elbow in the duct. All electrical equipment and controls for either lights or motors must be outside the booth. Fan blades must be of non-ferrous material, and for other than water spray booths should be of the propeller-blade type."

252.6 GARAGES. Section #8899 of the Minnesota State Industrial Commission's Code requires a minimum of six air changes an hour. However, the commission now recommends ten air changes in conformance with American Standards.

Tail pipe exhaust needed if cars are working with engines running. Tail pipe exhaust requirements are 400 cfm's per tail pipe, with 4½" flex duct.

Storage Garages. Real danger of carbon monoxide fumes. It is well to exceed 10 air changes an hour, especially if unheated, to at least 20 air changes an hour.

252.7 HOODS, SHOP: FORGE, WELDING, SOLDERING. Should be provided with mechanical exhaust systems providing a minimum of 100 fpm through the open area of the hood; blast-gate type dampers as necessary; ducts of non-combustible material.

252.8 CHLORINE GAS TANKS OR EQUIPMENT STORAGE ROOMS. (Relative to water purification, waste disposal, swimming pools). Ventilation is governed by Industrial Commission regulations:

Section

"All rooms or buildings housing chlorine tanks, valves, and chlorinators shall be ventilated as follows:

> "One mechanical air change per minute, properly exhausted at floor level and make up air shall be provided at or near the ceiling of such rooms."
>
> "Doors of such buildings shall be interlocked with the ventilation system in such a manner as to activate the ventilation system when the door is open."
>
> "In addition there shall be a switch controlling the ventilation system and such switch shall be placed on the outside wall of such building."
>
> "Chlorine gas being heavier than air shall be exhausted above or away from building openings and other places of employment."

253.0 SIGNATURE ON HEATING AND VENTILATING PLANS. The certification and signature of the person preparing the heating and ventilating plans, or under whose direct supervision the heating and ventilating plans were prepared should be placed on the appropriate sheet* A person in direct supervision of heating and ventilating plans, as referred to above, is construed to mean the person whose professional skill and judgement are embodied in the document signed, and who assumes the responsibility for the accuracy and adequacy thereof.**

---

*M.S. 1957 Section 326.12 Subd. 3.

**Rules of Minnesota State Board of Registration for Architects, Engineers, and Land Surveyors, 1956.

254–259 Reserved for future use.

SECTIONS 260-279. ELECTRICAL DESIGN AND COMMUNICATIONS EQUIPMENT

Section

260.0 RESPONSIBILITY. Recommendation: The electrical design for new school buildings and for major alterations to existing buildings should be prepared by a "Registered Professional Engineer, classified as an electrical engineer. Such engineer shall be duly qualified for registration as required by M.S. 1945, Section 326.02, as amended, and should be experienced in electrical design.

261.0 STANDARDS FOR ELECTRICAL DESIGN AND INSTALLATION. The electrical design and installation of all materials, devices, and equipment shall conform to the following standards:

ITEMS	AUTHORITY
a. For electrical materials, apparatus and equipment . . .	Underwriters Laboratories, Inc., (NBFU); Minnesota State Board of Electricity.
b. For installation of electrical materials, apparatus, equipment	National Electrical Code NFPA No. 70; Minnesota State Board of Electricity.
c. Safety Standards	Industrial Commission of Minnesota.
d. Emergency and exit lighting, and fire alarm systems . .	State Fire Marshal's Regulations or Conditions.
e. For elevators in schools	All standards listed above and: American Standard Safety Code for Elevators, Dumbwaiters, and Escalators and Manlifts; National Building Code; N.F.P.A. Building Exit Code.

NOTE: In addition to the above, the requirements of such local codes as exist and are applicable.

Section

262.0 ELECTRICAL SERVICE

262.1 CAPACITY. The capacity of the electric service system should be determined accurately, taking into consideration: (1) the safety of the occupants, (2) the future needs and expansion of the school plant, (3) the trend to provide higher illumination intensities, (4) the increased use of electrically operated equipment. When future additions are planned to an incomplete building, it is recommended that a recording ammeter be installed at the service entrance to accurately determine the average current demand of the building system and enable an accurate estimate of future demand needs.

262.11 Provision should be made so that new types of instructional equipment, possibly requiring high voltage, may be wired at a later date without disturbing the structure of the building.

262.2 SERVICE LINES. It is strongly recommended that all electric power service lines be placed underground on school sites.

262.21 Lines Carrying Over 600 Volts. Overhead electric power service lines carrying over 600 volts should not be used on school sites, with the exception of athletic field distribution systems.

262.22 Special Problems. When unusual conditions make compliance with 262.21 impracticable, an alternate solution should be discussed with the State Board of Electricity and the Director of School Plant Planning, State Department of Education.

262.3 SERVICE ENTRANCES

a. The service entrance shall be installed so as to insure safety to pupils and not to detract from the appearance of the building.

b. Conductors shall not be run within the hollow spaces of frame buildings unless provided with automatic over-current protection at their outer ends. See current edition of National Electric Code.

264.4 LOCATION

a. Main service panel should be located in accordance with N.E.C. Sec. 230-70.

b. The distribution panel, switches, motors, and main power and light panels should be located for emergency access and fully enclosed to prevent tampering by unauthorized persons.

262.41 A reasonable number of spare circuits should be provided for future use.

262.5 BRANCH PANELS. All branch panels should be provided with locks.

262.51 Corridor Panels. All panels located in public or traffic areas should be flush mounted and shall have locking covers.

262.52 Kitchen Panels. No kitchen or other panel should be located in the food storage room or kitchen toilet.

262.53 Shop Panel. Power panels for shop equipment should be located in the shop, be readily accessible, and have a main switch for emergency.

262.54 Stage Panels. Auditorium or other assembly area lighting, except emergency or exit lighting should be fed from a stage panel when a stage is provided. See Article 520 National Electric Code.

262.55 Receptacle Circuits. Receptacles in such units as homemaking rooms, science laboratories, language laboratories, and business education rooms shall be circuited so as to permit simultaneous use of all the usual equipment at the same time.

Section

262.56 Spare Circuits. Each branch panel shall have spare circuits or spaces for additional circuits and breakers, to provide for future addition or expansion.

263.0 ELECTRIC LIGHTING SYSTEMS. See Section 194.0 LIGHTING.

263.1 RECESSED INCANDESCENT LIGHTING FIXTURES. Care should be taken that recessed incandescent lighting fixtures have been approved for the conditions of use by a testing laboratory or be approved by the State Board of Electricity as conforming to Article 410 of the National Electric Code.

Attention is called to spacing the fixture enclosure a safe distance from adjacent combustible materials or accumulations of dust from air ducts which incorporate suspended ceilings for air transmission.

263.2 SWITCHES

263.21 Instructional Spaces. Switches in instructional spaces should be arranged to control lighting as necessary and economical for needs of the visual environment. If audio-visual equipment is to be used extensively and accompanied by considerable pupil notebook work, the use of dimmers is recommended. See Sec. 194.8 "Dimmers, Classroom."

263.22 Remote Control Switches. Each switch for lighting not readily observed from the switch location should have a pilot light.

263.3 SWITCH LOCATIONS AND TYPES

263.31 General

a. Some or all of the lighting in each space should be controlled by switches located in the room near the latch jamb of the door or doors used for circulation.

b. No switch shall be located in areas where electrical shock may exist for pupils, such as shower rooms, drip passages, or body drying rooms.

263.32 Assembly Lighting. Some or all general lighting in auditoriums, gymnasiums, combined gymnasium-auditoriums and lunch rooms should be controlled by switches at the doors used for circulation.

In auditoriums or rooms used for general assembly and equipped with stages or projection booths, switches must be provided in projection booths and on stages to control some or all the lights in the seating area. See National Electric Code: Articles 520, 530, and 540.

263.33 Silent Switches. Stage and auditorium lighting, unless dimmer controlled, should be controlled by silent type switches.

263.34 Corridors and Stairways

a. Three-way switches should be provided at the ends of corridors and at entrances, and at the head and foot of each exit stairway in multi-storied buildings, except for emergency lighting circuit, to permit turning lights on and off at these points when passing through the building. See National Electric Code, Article 700.

Section

b. Corridor lighting should be on a separate circuit, independent of other circuits. Separate emergency lighting may be provided as a part of the emergency lighting circuit. See N.E.C. Art. 700.

263.35 Key Operated Switches. These should not be used for general light control.

264.0 RECEPTACLES (Convenience Outlets)

264.1 GENERAL. All general purpose receptacles shall be designed to accept standard three wire grounded cord plugs.

264.2 INSTRUCTIONAL ROOMS. Each general instructional room should be provided with at least two duplex receptacles, one at the front and one at the rear of the room, located for convenient use of A-V equipment. A receptacle should be provided at each work counter, placed for pupil safety at least five feet from the sink.

264.3 SPECIALIZED INSTRUCTIONAL ROOMS. All types of science and art laboratories, business education, industrial arts, home economics and vocational shops or laboratories should be provided with a sufficient number and proper type of convenience and power outlets. These should be predetermined and included in the final drawings.

264.31. In SHOPS, consideration should be given to flexibility of the electrical service in order that machines and equipment may be easily installed or relocated when desired. See National Electric Code, Articles: 250, 430, and 500.

NOTE: In general, each student station should be provided electric service.

a. The 4 station work bench area should be provided with overhead stem type single phase electrical service to facilitate using electrical tools. The machine area should generally be provided with overhead 120/208 volt single and three-phase, four wire distribution service using electrical connections designed so as to provide flexibility in the location of machines. Only the circular saw should be *provided with* floor mounted electrical service.

b. Consideration may be given to the three-phase four wire current service along a portion of the walls of the machine area, or at least the proper size conduit should be provided for future machine installations. Motors, ½ H.P. or over, should be three-phase. Single phase 120-volt duplex receptacles should be provided at regular intervals along the perimeter of the shop.

264.32 In Business Education rooms and large business offices, electrical service should be provided by means of flush or under-floor ducts. In typing rooms, sufficient pupil stations should be provided with floor outlets for electric typewriters to enable every member of the class to acquire experience in their use. In business machine rooms sufficient wall outlets should be provided to afford all pupils practice in the various types of machines.

264.4 AUDITORIUMS. All auditoriums, combined auditorium-gymnasiums, and other areas that might be used for assembly purposes should be wired to accommodate either a portable, safety type motion picture machine or a type operated from a booth. A built-in speaker cable should be provided to run from the projector station to the permanent speaker, or to outlets conveniently located for use with the portable speaker.

264.5 CORRIDORS. Receptacles should be provided and properly located in the corridors and throughout the building for electric cleaning equipment and other similar uses. It is suggested that 30 ampere 240-volt receptacles be provided for heavy machines.

265.0 GROUNDING AND POWER CONTROL

265.1 GENERAL. In industrial arts, art, and vocational shops, every portable and stationary electrically operated device or motor, grinder, glue pot, etc., shall have its framework effectively grounded. All portable hand and stand lamps and electric tools shall be equipped with three wire cords and three pronged grounding electric plugs.

265.2 MASTER SWITCH. A lockable, master electric shut-off switch shall be provided for each shop for instructor control of electric power equipment and should be provided in any room where multiple electric machines are used, i.e., business machines, electric typewriters, electronic equipment in language laboratories, science laboratories, etc.

265.3 STARTERS AND PUSH BUTTONS. All starters and push buttons on machine tools shall be of momentary contact type. For application to electrical building equipment, refer to NFPA No. 70, Articles 430-443.

265.31 Electrically Operated Gymnasium or Room Divider Partition. See Section 272 for statement of Minnesota Industrial Commission requirement.

266.0 FIRE SAFETY SYSTEMS

266.1 EXIT ILLUMINATION AND SIGNS. See Sec. 125.101–125.106, "Fire Safety."

266.2 FIRE ALARM SYSTEMS. See Sec. 130.0–130.24, "Fire Safety."

267.0 COMMUNICATIONS SYSTEM. The engineer should provide suitable raceways to accommodate signal or bell system, intercom P.A. system, telephone system, closed circuit T.V. system, and any new system known to be in process of development and practicable.

267.1 SIGNALING SYSTEM

267.11 All new school buildings of six or more classrooms should be wired for a signal system. In buildings of less than six classrooms, it is recommended that conduit for this purpose be installed in the building where there is a likelihood of future additions.

267.12 In all secondary schools and elementary schools operating on a departmentalized basis, an independent program signal system should be installed. In all schools a system should be installed that automatically corrects clocks after current interruption.

267.13 Electric clocks and public address speakers in classrooms should preferably be installed above the exit door, rather than in the front of the classroom, so as not to interfere with A-V projection activities.

267.2 INTERCOMMUNICATION SERVICES. Some kind of intercommunication system and/or central sound system should be installed in all secondary school buildings, and in all elementary school buildings of six or more classrooms. Conduit should be installed in ALL new school buildings. See Section 100.27. "The Administration Unit."

267.21 Telephone. Every school building should have at least one telephone installed for emergency and general use.

267.22 Outlying Service Areas. Consideration should be given to the proper installation of telephone for service areas such as offices, kitchen, custodial unit, auditorium and gymnasiums. In large schools, private telephone intercommunication between the administrative unit, classrooms, and outlying service areas has certain advantages over loud speaker (public address) intercommunication, such as privacy, ease of initiating communication between rooms. See Section 100.28 "Administration Unit."

267.3 SOUND SYSTEM. Every sound system has the functions of picking up sound (recordings, speech, an activity program), transmitting it electrically, and reproducing it. These are accomplished by microphones, amplifiers, and loudspeakers. See the following:

Section 100.27 a. "Planning a School Intercom System."

Section 100.27 b. "Sound (Public Address) System."
(space and equipment).

267.31 Limited Sound System. If a complete sound system is not provided, the auditorium or assembly area should be provided with a sound system. This may be a portable system but, preferably, should be built-in to include loud speakers to which can be transmitted stage activities, sound motion pictures, tape or disc recorded programs by way of microphone jacks and proper amplifier controls.

267.4 AUDIO-VISUAL EQUIPMENT NEEDS. See "Instructional Materials Center," Sections 52.7 and 73.0.

276.5 FOREIGN LANGUAGE LABORATORY. For space and electro-mechanical equipment requirements and recommendations, see Section 75.0 "Modern Foreign Language Facilities." Lighting fixtures should be selected which do not interfere with audio devices after consultation with the electrical engineer.

267.6 TELEVISION. Classroom receptacles will accommodate television receivers used for standard channels. Additional build-in equipment such as an ANTENNA SYSTEM and a CLOSED CIRCUIT COAXIAL SYSTEM will be neceessary to utilize television more comprehensively. With an extensive installation, the closed circuit television can serve many of the functions of a public address system as well as those for instructional needs. See Section 73.0 "Audio-Visual Service Area."

268.0 SIGNATURE ON ELECTRICAL PLANS. The certification and signature of the person preparing the electrical plans and specifications or under whose direct super-

Section

vision the electrical plans and specifications were prepared shall be placed on the appropriate sheet (M.S. 1957 Sec. 326.12 Subd. 3).

A person in direct supervision of electrical plans and specifications, as referred to above, is construed to mean the person whose professional skill and judgement are embodied in the document signed, and who assumes responsibility for the accuracy and adequacy thereof. (Rules of Minnesota State Board of Registration for Architects, Engineers, and Land Surveyors, 1956.)

269.0 REVIEW OF ELECTRICAL PLANS. If the electrical engineer desires to have the electrical plans and specifications reviewed by the office of the Minnesota State Board of Electricity, and this is done, then this paragraph should be inserted in the electrical section of the specifications:

> "These plans and specifications have been reviewed by the Minnesota State Board of Electricity at the request of the architect or engineering firm. The cost of this service shall be included in the bid, considered part of the electrical construction costs, and paid by the electrical contractor in addition to the usual field inspection fee. Such fees shall be paid to the Minnesota State Board of Electricity."

270.0 CERTIFICATE OF INSPECTION. The electrical contractor shall furnish a copy of the final inspection certificate, signed by an inspector of the State Board of Electricity, or by the inspector of a municipal agency when the statutes so permit, to the owner, the architect and the electrical engineer before final payment is made by the owner.

271.0 SWIMMING POOL WIRING

271.1 APPROVED METHOD OF BONDING STEEL MEMBERS TO ELECTRICAL GROUND SYSTEM. The following method of bonding structural steel members of a swimming pool to the electrical ground system is approved by the State Board of Electricity as meeting the requirements for an acceptable bond referred to in Article #680 of the National Electric Code. The reinforcing structural steel referred to is any portion which is embedded in the swimming pool bulkheads, bottom, or decks.

(1) The various pieces of reinforcing structural steel are bonded into one by a simple criss-cross of welding.

Section

(2) Then a single pressure connector to the grounding conductor will ground all steel in a manner stipulated by code provisions.

NOTE: See National Electric Code provisions: Section 680-7-a; Section 680-8-c; Article 250, part G; Section 250-72-a and d; Section 250-79; and Section 250-113.

Structural steel members which are bound together by the usual tie-wire do NOT provide an acceptable bond to the electrical ground system since the tie-wires are short-lived under moisture conditions prevalent in concrete slab in Minnesota. In a short period of time, sections of the structural steel isolated by deterioration of the tie-wires will not conduct stray currents through the grounding system with low enough impedance to open the overcurrent protective devices.

271.2 APPROVED METHOD OF GROUNDING METAL DIVING PLATFORMS, BOARDS, AND LADDERS. See National Electric Code, Sec. 680-5.

272.0 FOLDING PARTITIONS—POWER OPERATED
(Gymnasium or Room Dividers)

NOTE: The following requirement of the INDUSTRIAL COMMISSION OF MINNESOTA, under authority of M.S. 182.01, was adopted February 26, 1963, after the accidental death on February 1, 1963, of a ten year old school boy when riding on a powered folding partition.

"(a) Power operated folding partitions shall be moved by means of two properly located key operated switches.

"(b) Switches shall be located on opposite sides of folding partitions so that each switch operator will have full view of the side that he is operating.

"(c) Switches shall be key operated and designed so that keys must be held in operating positions against spring pressure. Switches shall be designed to fail safe. Switches shall be electrically interlocked to prevent any movement of a folding partition by only one switch.

"(d) Switches shall be free from obstruction and ready for immediate use.

"(e) The views of switch operators shall not be obstructed."

273–279 Reserved for future use.

SECTIONS 280-289. PREPARATION OF PLANS AND SPECIFICATIONS

Section

280.0 FINAL PRELIMINARY PLANS. When construction is contemplated for new buildings, additions to existing buildings, or for major remodeling or alterations of existing buildings, the preliminary plans should be submitted to the State Department of Education, School Plant Planning Section, for review and preliminary approval before the preparation of working drawings is undertaken. Preliminary plans submitted for review should incorporate the following drawings and statements where applicable:

280.1 SITE PLOT PLAN TO SCALE SHOWING:

- a. Size and shape of entire site with property and over-all dimensions.
- b. Points of the compass.
- c. Street names, highways, sidewalks, etc., adjacent to the property.
- d. All existing utility services, such as electric lines and poles, and including electrical services, sewers, manholes, water mains and services, dry wells, catch basins, wells, sewage disposal systems, etc.
- e. All proposed service drives, and parking areas on the site.
- f. Location of proposed building on the site and future additions.
- g. Location and nature of existing buildings on the site.
- h. General layout of athletic field and playground facilities.

280.2 FLOOR PLANS TO SCALE NOT LESS THAN 1/16" TO THE FOOT SHOWING:

- a. Location approximate size, and purpose of rooms, and locations of boiler rooms.
- b. Location and size of stairs, exits, and corridors.
- c. Location of doors and windows.
- d. Location of plumbing fixtures.
- e. Over-all dimensions.
- f. Future additions.
- g. Some indication of existing building to which addition is to be made.

280.3 ELEVATIONS, AT SAME SCALE AS PLANS, OF AT LEAST TWO SIDES OF BUILDING, SHOWING:

- a. Floor and roof lines.
- b. Story heights.
- c. Approximate size and type of windows and their relation to floor and ceiling.
- d. Grade lines.

280.4 PERSPECTIVE OR ELEVATION DRAWINGS, Showing: Major elevations, or model photographs, if available, may be submitted if desired.

280.5 OUTLINE SPECIFICATIONS

- a. Type of structural system, exterior and interior wall construction.

Section

- b. Floor, wall, and ceiling finishes of classrooms, corridors, toilets, and other rooms.

281.0 FINAL DRAWINGS AND SPECIFICATIONS. Before bids for construction are let, plans and specifications covering the construction of new buildings, additions to existing buildings, or for major alterations of existing buildings must be submitted in duplicate to the State Department of Education, School Plant Planning Section, for review and approval. Final drawings and specifications should include the following items where applicable:

281.1 DATE AND SIGNATURE. Each sheet of drawings and addenda should bear an original date, the date of each revision, and the signature of the person responsible for the drawings. Specifications should bear an original date and signature.

281.2 PLOT PLAN, Showing:

- a. Size and shape of entire site with property lines and over-all dimensions.
- b. Points of the compass.
- c. Complete topographical map of the site with finished contours, including finished grades at building, and elevation of floors, elevations of sewers and manholes, location of power poles.
- d. Street names, highways, sidewalks, etc., adjacent to the property.
- e. Service drives, sidewalks, and parking areas on the site.
- f. Location of new buildings on the site and proposed future additions.
- g. Location and nature of existing buildings on the site.
- h. All utility services to the building with connections to present utilities or the newly developed utilities, including water, sewage disposal, gas, telephone, and electric power services.
- i. General landscaping with location of walks, drives, parking areas, athletic field, playground facilities, gardens, pools, etc.
- j. Building accurately located on the site by dimensions extending from the building to property line or benchmarks.
- k. Location of flagpole (display of flag required by law.)
- l. Location of test borings.

281.3 PLANS (Architectural)

- a. All plans and elevations whenever feasible drawn to scale of not less than ⅛" to one foot. (Sheets over 3' long when rolled are not acceptable.)
- b. Foundation plans and footings fully dimensioned and indicating reinforcing.
- c. Each floor plan.
- d. Indication of existing building, as necessary, if an addition is to be made.

Section

e. Roof plan (may be drawn to a scale of not less than 1/16" to one foot).

f. Schedule showing type and size of doors.

g. Dimensions so that room sized, thickness of partitions and walls, and size of building can readily be determined.

h. Each room and space titled, indicating its purpose, either by room (preferable) or by schedule on the same page.

i. Elevation of finished floors.

j. Furred walls and ceilings.

k. Door swings.

l. Location of built-in equipment and fixtures.

SPECIAL NOTE: Four duplicate prints drawn to ¼" scale of facilities as follows: agriculture, art, home economics, industrial arts, library, and science laboratories must be submitted to Building Section for evaluation and prior approval before being incorporated into final drawings and specifications.

m. Indications of materials used in all walls, partitions, etc., with proper symbol.

n. Schedule showing all finished material, painting, etc., for floors, base, walls, wainscots and ceilings.

o. Key plans provided on each drawing indicating portion of building that appears on each sheet (when drawing exceeds sheet size).

281.31 Exterior Elevations

a. All elevations, including courts, at same scale as plans.*

b. Elevations of essential portions of the existing building if an addition is to be made.

c. Indication of grade lines, steps, areaways, footings, foundation walls and vertical dimensions for areaways, floor levels, height of window stools and heads above finished floors in instructional areas.

d. Indication of kinds of materials.

e. Large scale elevation where necessary.

f. Key plans on each drawing indicating portion of building that appears on each sheet (when drawing exceeds sheet size).

---

*For large buildings with a great deal of repetitive units, 1/16" elevations may be permitted upon special request in each case.

281.32 Sections

a. As many sections as are necessary to show clearly any special conditions at any suitable scale.

b. Typical sections of stairs, classrooms, corridors, furred ceilings, built-in equipment and fixtures, floor construction levels and thickness, wall construction, typical and special windows, interior and exterior door frames, finish material, roof construction, etc., as may be required to interpret properly the drawings.

c. Key detail sections clearly marked on the typical sections, elevations and plans to determine readily the points through which the sections are taken.

Section

281.33 Interior Elevations

a. Finish materials, ceiling heights, change in floor levels, grilles, ducts, etc. Interior elevations at ¼" scale or larger are desirable.

281.34 Details, Appropriate Scale

a. Necessary exterior and interior wall sections, footings, foundations, floors, windows, cornice, roof, etc., including all pertinent dimensions.

b. Each type of door frame, trim and sills where necessary.

c. Details of each type of window together with dimensions from floor to stool, height and width of window, and height from top of window to ceiling.

d. Stair details with all dimensions of risers, treads, all hand rails including wall rails and intermediate rails, height of hand rail above treads, newels, landings, balusters, balustrades, return balustrades at head of stairs, etc.

e. Chalkboard and tackboard trim, chalkrail with height from floor, height and width of all chalk and bulletin boards, built-in equipment including counters, shelving, bookcases, cupboards, drawers, etc., completely dimensioned.

f. Wardrobes, lockers, closets including teachers' closets with means of ventilation clearly indicated.

g. Toilet room accessories and all other permanent equipment forming an integral part of the building.

h. Layouts of equipment in all educational rooms, laboratories, lunchroom, and kitchen at scale.

281.4 STRUCTURAL DRAWINGS

a. Drawings covering the structural design separate from the architectural drawings, except for small buildings.

b. Fireproofing of structural members where required.

c. Design data showing loading in accordance with Sections 152.0–155.0.

d. Details, diagrams, and schedules as required for a complete understanding of the plans.

281.5 HEATING AND VENTILATING PLANS

a. Separate heating and ventilating plans at not less than ⅛" scale.

b. The boiler, detailed in plan and required elevations, with all connections, including pumps, piping and related equipment.

c. Motors and fans showing type and capacity. (These may be in specifications.)

d. Locations, sizes and capacity of all ducts, grilles, ventilators, etc.

e. Location and capacity in equivalent square feet, EDR (steam) or MBH (hot water), of all radiation.

f. Details showing size and arrangement of pipe, location in the construction, special details showing how pipes are concealed and detail of expansion joints, where necessary.

g. Schedule of important material items unless covered by specifications.

Section

- **h.** Size, location, and depth in ground, method of securing fuel oil storage tanks.
- **i.** Alterations and additions for existing buildings, as outlined above.
- **j.** Schematic diagram of toilet exhaust duct systems.
- **k.** Air conditioning equipment details and piping.

281.6 Plumbing Plans

- **a.** Separate plumbing plans at not less than 1/8″ scale are recommended but may be combined with heating and ventilating plan.
- **b.** Footing drains and storm water disposal.
- **c.** Complete water supply system showing pipe sizes (isometric diagram), hot and cold water storage tanks, location of any well, location and setting of any pumps.
- **d.** Location of all plumbing fixtures including hose bibs and hose cabinets if any.
- **e.** Pumps, hot water tank and connections, supply and return lines with size of valves, direction of slopes, etc.
- **f.** Sanitary sewer lines and sewage disposal system.
- **g.** Schedule of fixtures unless covered by specifications.
- **h.** Provision for future expansion of water lines, storage tanks, and toilet facilities.
- **i.** Alterations and additions for existing buildings as outlined above.
- **j.** Gas lines including sizes, safety valves, and methods of venting gas equipment. (Main gas lines should not be run under buildings.)
- **k.** Plumbing waste and vent system complete with riser diagram.

281.7 ELECTRICAL PLANS

- **a.** Separate plans at not less than 1/8″ scale.
- **b.** Inside and outside electrical connections.
- **c.** Location of wall, floor and ceiling outlets, or receptacles.
- **d.** Type of light fixtures, size of lamps or tubes.*
- **e.** Locations and details of switch panels, circuit breakers, fusing, etc.*
- **f.** Location and connections for all bells, alarms, clocks, telephone, television and radio outlets, and all necessary outlets for equipment in special rooms such as laboratories, home economics, business education, shops, etc.

Section

- **g.** Riser and circuit diagrams showing conduit wire sizes for electrical systems.
- **h.** Hanging height of fixtures from the floor to the bottom of fixtures, and from the bottom of the fixture to the ceiling for suspended fixtures.
- **i.** Schedule of all important material items unless covered by specifications.
- **j.** Alterations and additions for existing buildings as outlined above.
- **k.** Size of service.
- **l.** Underground service.

---

*Unless shown in specifications.

282.0 SPECIFICATIONS

281.1 GENERAL

- **a.** The type and construction of each building will determine the extent to which covering specifications are needed. The plans, by the various drawings, show the building design. The specifications give specific directions, and requirements in written form and detail. When a question of intent is to be decided in any legal action, the specifications are generally conceded precedence over the plans. Therefore it is most important that a complete set of specifications be prepared.
- **b.** In all cases, any provision made for future expansion should be outlined in a separate paragraph entitled "Provision for Future Expansion." This will aid the school board, architects, engineers, and the Department of Education in future planning.

282.2 STANDARD CHECKLIST FOR SPECIFICATION TITLES

A "Standard Checklist for Specification Titles" has been developed by the Joint Cooperative Committee: Minnesota Society of Architects of the AIA and the Associated General Contractors of Minnesota in cooperation with the Minnesota Association of Consulting Engineers.

NOTE: Copies of this Standard Check List are available from the AIA-AGC Joint Committee, 910 Builders Exchange Building, Minneapolis 2, Minnesota.

282.3 EQUIPMENT MANUALS AND OPERATING INSTRUCTIONS. Include in specifications a statement that the contractor shall furnish and turn over to the school district (owner) three copies of manuals fully describing operation and maintenance of each piece of equipment installed under the contract, and a list of names and addresses of the nearest supply houses carrying spare parts for such equipment.

283-289 Reserved for future use.

INDEX

Note: In the Index which follows, Section and Subsection numbers are used rather than page numbers to identify and locate materials in the Guide. Sections are identified by whole numbers, such as 1., 25., 175., and subsections by decimals following the whole numbers, such as 1.6, 30.71, 190.38.

In locating sections and subsections in the Guide from the index, note the top of the Guide pages. The number at the top of the left-hand page, upper left, indicates the first section or subsection heading on the page. The number at the top of the right-hand page, upper right, indicates the last section or subsection heading on that page.

Section or Subsection

Acoustical Treatment. See Sound Control

Administrative Unit, 101.1–101.6
- Conference room, 100.24
- Data processing space, 100.29
- Communications system, 100.27
- Offices, 100.23
- Public reception space, 100.21
- Staff toilets, personal storage, 100.25
- Storage: vault, supply, and textbooks, 100.26

Adult Education Room, 104.3

Agriculture Facilities, 81
- Classroom, 81.33
- Laboratory, 81.34
- Machinery court, 81.36
- Mechanized shop, 81.35
- Office-conference room, 81.32

Air Changes, 241.1

Air Conditioning, 240.3, 241.2
- Guide (ASHRAE), 233.a, 247.2
- Windowless classrooms, 198.1 (3)

Alarms, Fire, 130–130.24

Approval
- Plans and specifications, 3–3.1, 5.5–6.5
- Sites, 3.0, 3.1, 5.4–5, 40.5

Area Vocational-Technical School, 85

Art Education Room, 77
- Chalkboard and display, 77.42 f.
- Facility elements, 77.42
- Floors, 77.74
- Location, 77.3
- Program, 77.11
- Storage, 77.42 d.
- Suggested floor areas, 77.5
- Teaching stations, 77.2
- Utility services, 77.6
- Washing and sink areas, 77.61

Artificial Lighting. See Lighting

Assembly Rooms. See Auditoriums

Athletic Facilities
- Drying room, 87.53
- Office, 87.46, 87.55
- Supply room, 87.52
- Team room, 87.51
- Outdoor areas, 87.91–87.96

Athletic Institute, Inc.
- "National Guide," 87.1

Section or Subsection

Audio-Visual Education
- Center functions, 73.1 c.
- Classrooms and assembly rooms, 73.1 a., b.
- Elementary school, 53
- Equipment and storage, 73.4
- Instructional materials center, 72–72.02
- Materials and storage, 73.5
- Materials production, 73.6
- Orientation, 73.2
- Service areas, 73.32
- Suggested floor areas, center spaces for various sized schools, 73.7

Auditoriums and Assembly Rooms
- Elementary schools (multipurpose), 57
- Secondary schools
  - Balconies, 106.2, 106.53, 125.93
  - Cafetorium, 106.91
  - Circulation, 106.71
  - Combination gymn-auditorium, 106.9
  - Dividers, instructional areas, 106.4, 272
  - Dressing rooms, 106.75
  - Electrical, 106.78; lighting, 106.59, 106.77
  - Floor, 106.72
  - Fire safety, 106.51, 106.79, 120–136
  - Orchestra space, 106.6
  - Projection station, 106.57, 106.58
  - Seating, 106.51, 129.0
  - Size, 106.2
  - Stages, 106.7–106.77
  - Storage, 106.79a

Band Room, 78.21

Biology Laboratory, 75.22

Bleachers and Grandstands, 129.12–129.31

Board of Electricity, State, 6.4, 261.0, 269–270

Board of Health, State, 6.1, 41.51

Board of Registrations, Architects and Engineers, 6.5

Board, Local School, 2.0, 7.2, 20–39

Boiler Rooms, 123.1–123.3, 233, 242, 244

Bond Attorney, 24.3, 25.1 d., 25.3

Bond Consultant, 24.2, 24.6

Bond, Performance, 25.4 Annotation 1.

Bonds, Building, 24.5, 24.6

Bookshelves
- Classroom, 51.21 e., 51.31, 71.6 d.
- Library, 52.31, 52.32, 72.32, 72.331

Brightness Differences, 193.1-194.2

INDEX

Section or Subsection

Building Capacity
  Elementary, 50.31
  Secondary, 70.12

Building Codes
  Electrical design, 261
  Fire marshal's, 120–149
  Heating and Ventilating, 233
  Plans and specifications, 280–289
  Plumbing, 211
  Structural design, 152

Building, Elementary. See ELEMENTARY SCHOOL BUILDING

Building, Secondary. See SECONDARY SCHOOL BUILDING

Bulletin Board. See DISPLAY

Bus Garages, 111, 134

Business Education Facilities, 82
  Bookkeeping and general business, 82.32, 82.35
  Data processing, 82.32, 82.38
  Multiuse laboratory, 82.32, 82.37
  Office procedures and special machines, 82.32, 82.36
  Shorthand, typewriting, 82.32, 82.36
  Typewriting room, 82.32, 82.33

Cafeteria. See SCHOOL LUNCH

Cafetorium, 106.91

Carpeting, 52.31, f., 72.31, h., 101.33

Ceiling Heights, 199.2

Central Forced Air System, 234.3

Central Service Building, 100.6

Certificate
  Building completion, 5.54
  Electrical inspection, 6.4, 261, 269, 270

Chalkboards
  Administrative offices, 100.23
  Agriculture, 81.33 (5)
  Art, 77.42 f.
  Business education, 82.44
  Elementary classrooms, 51.33
  Home economics, 84.56 b.
  Industrial arts, 79.76
  Kindergarten, 51.23
  Language lab, 74.13
  Phy. ed. office, 87.46
  Secondary classrooms, 71.6
  Science, 75.42

Changes in Construction Plans, 26.2

Chemistry Lab, 75.23

Chimneys, 135.5, 242.6

Chorus Rooms, 78.22

Classrooms
  Elementary, 51.1–51.34
  Secondary, 71.1–71.9
  Specialized, 74–88

Section or Subsection

Clocks, 51.23, 51.34 g. (10), 71.6 h., 267.12, 267.13

Codes, Building. See BUILDING CODES

Combined Gymn.-Auditorium, 106.9

Communication Facilities
  Alarms, 130
  Intercom system, 100.27, 267.2, 267.6
  Signaling system, 267.1
  Telephone, 100.28

Community Use of School Plant
  Auditoriums, multipurpose rooms, 57.1 b. (2), 57.21, 106.2, 106.3
  Food service facilities, 105.2 b. (3)
  Public toilets, 216.35
  Swimming pool, 87.344
  Zoning, 248.2, 250.91

Conference Rooms
  Administration, 100.24
  Agriculture, 81.32
  Counseling, 101.23
  Instructional materials center, 72.01
  Library, 52.12 d., 52.5, 72.6
  Seminar study, 70.4 b.
  Student activity, 104.12

Construction, Building, 26–29
  Certificate of completion, 29
  Changes in plans, 26.2
  Final inspection, 26.3
  Final settlement, 26.4
  Inspection during construction, 26.1
  Inspection during guarantee period, 29 Annotation
  Insurance during construction, 25.1 d.
  Putting building into service, 27

Contract, Building
  Bids, 25.3
  Contract award, 25.4
  Contract form, 28
  Prior approval of plans, 25.1 e.

Contractors Performance Bond, 25.4 Annotation

Controls, Thermal, 235, 248

Cooperative Planning, 24.4, 41.2

Corridors
  Construction, 126.1
  Dead end, 124.25
  Obstruction of, 126.4
  Termination, 126.5
  Width, 126.2–126.26

Counters
  Agriculture, 81.34
  Art, 77.42 c.
  A-V education 53.3, 73.6
  Business education, 82.33–82.37, 82.46
  Custodial workshop, 110.23
  Elementary classrooms, 51.31, 51.33
  Food service, 105.452, 105.465, 105.6–2
  Home economics, 84.51

INDEX

Section or Subsection

- Library, 72.44, 72.63
- Secondary classrooms, 71.9
- Special education, 54.32, 59,612, 59.73

Custodial Facilities, 110

Darkroom, 72.01 b., 73.32, 73.7 b.c.

Data Processing, 76.2, 82.3, 82.38, 85.3

Daylight Controls, 73.1, 194.8, 196.2

Desks, Seating
- Administrative offices, 100.23
- Agriculture, 81.33 (3)
- Art rooms, 77.42
- Auditoriums, multipurpose rooms, 57.23, 57.42, 106.51, 129
- Business education, 82.33–82.37
- Classrooms, general, 51.34 c., 71.3
- Food service areas, 105.471, 105.472
- Grandstands, bleachers, 129.12–129.31
- Gymnasiums, 56.22, 56.23, 87.32
- Library reading rooms, 52.332, 72.332
- Mentally retarded, 59.622 b.
- Science areas, 75.12
- Visually handicapped, 59.14 b.

Dining areas, 105.47–105.473

Direct Radiation Heating, 234.1

Disaster Shelters, 105.55, 156, 198.2

Dishwashing Facilities, 105.46, 105.6

Display
- Administrative unit, 100.21, 100.23
- Agriculture, 81.33 (6)
- Art, 77.42 f.
- Auditorium, 106.4
- Business education, 82.41, 82.42
- Dining Rooms, 105.472 f.
- Distributive education, 83.6 b.
- Elementary classrooms, 51.33
- Foreign language classrooms, 74.13
- Guidance center, 101.21 (5)
- Health suite, 102.31
- Home economics, 84.56 c.d., 84.58
- Industrial arts, 79.76
- Kindergarten, 51.23
- Library, 52.338, 72.338
- Music rooms, 78.51
- Phy. ed. offices, 87.46
- Science, 75.42, 75.43
- Secondary classrooms, 71.6 b.c.
- Student activity rooms, 104.15
- Teachers workroom, lounge, 103.51

Dividers. See PARTITIONS.

Doors
- Building exits, 125–125.946
- Fire doors, 128.6–128.63
- Hardware, 125.5
- Interior, 128
- Shops, 81.35 f., 79.75
- Vestibule, 125.6

Drainage
- Plans and spec., 281.6

Section or Subsection

- Sanitary, 214.3
- Sites, 41.61, 43.2, 43.41
- Storm, 213.6

Drains, Floor
- Kitchens, 105.444, 105.445 b., 105.466 f.
- Locker-dressing rooms, 87.41. f.
- Plumbing, 213.55

Drapes, 135.1, 196.2

Dressing Rooms
- Auditoriums, 57.1 d., 106.75
- Gymnasiums, 56.41, 87.41

Drinking Fountains
- Design and mounting, 217.64, 217.65
- Heights, 218.1
- Locations, 217.62
- Quantity, 217.61

Driver Education, 88

Driveways, 43.53

Ducts, 251–251.72

Dust Collection, Shops, 79.81 c. (3)

Economy, 20.a., 43.4

Educational Planning
- Conference, state director, 21.5
- Determining needs, 21–21.5
- Preliminary planning phase, 23.1
- Superintendent, 7.1 (1)–(8)

Electrical
- Exit illumination and signs, 125.94–125.946
- Communications system, 267–267.6
- Design and installation standards, 260, 261
- Fire safety system, 130, 266–266.2
- Grounding and power control, 265–265.31
- Inspection, certificate, 270
- Lighting system, 194, 263
- Partitions and dividers, electrically operated, 272
- Plans and spec., 281.7
  - Review, Board of Electricity, 269
  - Signature on, 268
- Receptacles, 264–264.5
- Service, building and site, 262–262.56
- Swimming pool, wiring, 271–271.2
- Switches, 263.2–263.35

Electrical Equipment
- Audio-visual, 53.5, 73.4, 73.8a
- Administrative spaces, 100.27, 100.28
- Alarm system, 130–130.24
- Auditoriums, 57.3 e., 57.31, 106.77, 106.78
- Business education, 82.33–82.37, 82.47
- Classrooms, general, 51.34 g., 71.6 h.
- Communications equipment, 267.2–267.6
- Elevators, 136, 261 e.
- Food service areas, 105.445 d., 105.473 g., 105.521 c. (3)
- Handicapped children, 59.27 b., 59.46 b.f., 59.96
- Language laboratories, 74.11, 74.15, 74.17, 74.18, 74.2–74.23, 74.28, 74.29 f.g., 74.31, 74.32

INDEX

Section or Subsection

- Maintenance, 74.4, 110.21
- Program clocks, signaling system, 267.1–267.13
- Room dividers, partitions, power operated, 272
- Shops, 79.83

Electronic Classroom, 74.3–74.32

Elementary School
- Auxiliary instruction room, art, etc. 51.32 c.
- Central and auxiliary facilities
  - Administrative unit, 50.2b, 100
  - Guidance area, 101
  - Health area, 102
  - Multipurpose room and stages, 57, 106
  - School lunch, 58, 105
  - Teachers rooms, 103
- Classrooms, elementary, 51.3–51.34
- Classrooms, general
  - Ceiling heights, 51.13
  - Design, 51.1
  - Floor area, 51.12 a.b.
  - Variable size, 51.12 e.
- Electrical service (checklist), 51.34 g.
- Furniture, 51.34 c.
- Instructional materials center, 52, 53
  - Audio-visual areas, 53
  - Library areas, 52
- Kindergarten, 51.21–51.24
- Music rooms, 51.32 c., 55.78
- Phy. ed. unit, 56
- Planning procedures, 1–39
- Remedial center, 54
- Safety, health, engineering
  - Electrical design, installation, 260–279
  - Fire and life safety, 120–149
  - Heating and ventilating, 230–259
  - Lighting and fenestration, 190–209
  - Plans and specifications, 280–289
  - Plumbing design, sanitary fixtures, 210–229
  - Sound control (acoustics), 170–189
  - Structural design, 150–169
- Service facilities: equipment maintenance and custodial services, 110
- Swimming pool, 87.341
- Toilet rooms, fixtures, 51.32, 216.26–218.1

Elevators, 136, 261

Elevation, Site, 41.6, 43.41

Engineers
- Mechanical system
  - Manual of instructions, 239
  - Performance tests, 238

Engineering Design
- Electrical, 260–279
- Fire safety, 120–149
- Heating and ventilating, 230–259
- Lighting and fenestration, 190–209
- Plumbing, 210–229
- Sound control (acoustics), 170–189
- Structural, 150–169

Enrollment Projection, Census, 21.1–21.2

Section or Subsection

Equipment and Furniture
- Administrative areas, 100–100.29
- Agriculture, 81.32–81.36
- Art rooms, 77.42
- Auditoriums, multipurpose rooms, 57.23–57.5, 106.4–107
- Business education, 82.33–82.47
- Classrooms
  - Kindergartens, 51.21–51.24
  - Elementary, 51.31–51.33
  - Secondary, general, 71.6
- Custodial services, 110.3–110.6
- Electrical. See ELECTRICAL EQUIPMENT
- Food service, 105.4–105.5, 106
- Guidance center, 101.2–101.4
- Handicapped children, 59.02–59.98
- Health center, 102.3–102.7
- Health classroom, 87.35
- Home economics centers, 84.5
- Instructional materials center(s)
  - Audio-visual, 53.3, 53.5, 73.4–73.8
  - Library, 52.33, 72.33–72.9
- Language lab, 74.1–74.3
- Lounge, teachers, 103.3
- Math lab., 76.1–76.2
- Music rooms, 78.2–78.5
- Physical ed. and recreation
  - Athletic program, 87.5
  - Fountains, cuspidors, 87.6
  - Locker, dressing rooms, 87.41
  - Offices, 87.46
  - Outdoor facilities, 87.9
- Plumbing (sanitary) fixtures, 217–218
- Science, 75.12, 75.2–75.4
- Shops, 79.5–79.6, 79.76
- Stages, 57.3, 106.7
- Teachers workroom, 103.2

Exhaust Ventilation, 252

Exits and Entrances, 125

Exterior Lighting, 43.53.b., 193.3

Extinguishers, Fire, 131

Fallout Shelters. See DISASTER SHELTERS

Fans, Ventilation, 250.4

Farm Mechanics, 81

Fenestration, 197

Financing Plant Program, 24

Finishes
- Flame spread rating, 127
- Reflection factors, 193.4

Finishing Rooms, 79.56, 134.5–134.6

Fire Marshal's Office, Duties, 6.2

Fire Marshal's Building Standards
- Alarm systems, 130
- Boiler and heating plant rooms, 123
- Building plans, review, 6.2, 137

INDEX

Section or Subsection

- Construction
  - Restrictions, 122
  - Types of, 121
- Corridors, 126
- Doors, 128
- Drapes, curtains, etc., in places of assembly, 135.1
- Elevators, 136
- Exits, 125
- Extinguishers, equipment, 131
- Finishes, flame spread ratings, 127
- Gas transmission and service lines, 132
- Hazardous areas
  - Areas using flammable liquids
    - Garages, 134.8
    - Shops, 134.3
  - Finishing rooms, 134.5
  - Kilns, 134.7
  - Service pits, 134.81
  - Spray painting booths, 134.6
- Incinerators, destructors, 133
- Seating and aisles, assembly, 129
- Stairways, 124
- Storage of flammable supplies, 135.2
- Welding in area using flammable liquids, 134.4

Fixtures. See LIGHTING

Flexibility, 51.1, 70.5

Floors, Ramps

- Art, 77.4
- Auditoriums
  - Seating areas, 106.52
  - Stages, 106.73
- Bus garages, 111.3 (7)
- Counselor's office, 101.33
- Elementary classroom, 51.34a
- Food service areas
  - Dining area, 105.473c
  - Kitchen, 105.444
- Gymnasiums
  - Elementary, 56.31
  - Secondary, 87.76
- Handicapped children, 59.93
- Home economics, 84.63
- Language labs., 74.29c
- Library, 52.31f., 72.31 h.
- Locker dressing rooms, 87.41 h.
- Multipurpose rooms, 57.25
  - Stage, 57.3 b.
- Science, 75.56
- Shops
  - Agriculture, 81.35 h.
  - Industrial arts, 79.71
- Shower rooms, 87.42 f.
- Toilets, 216.44

Food Service Facilities

- Central vs. individual school, 105.51
- Equipment, 105.52, 105.6
- Floor areas, basic spaces, 105.331
- Location, 105.2
- Planning facilities:
  - Arrangement, flow chart, 105.32, 105.321

Section or Subsection

  - Dining area, 105.47
  - Dishwashing facilities, 105.46
  - Kitchen areas, 105.44
  - Maintenance area, 105.43
  - Office area, 105.48
  - Receiving area, 105.41
  - Serving area, 105.45
  - Storage areas, 105.42
- Refrigeration: coolers, freezers, 105.442, 105.6–2

Fume Hoods, 75.23, 75.52, 252.3

Furniture, See EQUIPMENT

Garages, School Bus, 111

Gas Service:

- Building supply lines, 132
- Liquified petroleum gas, 243.2
- Master control valve, 132.2, 132.4
- Site, 41.5
- Standards, heating, 233

General Purpose Classrooms

- Elementary, 51
- Secondary, 71

General Science Lab. See JUNIOR HIGH SCIENCE LAB.

Glare, 193, 194

Grounds, School, 41–44, 56.5, 87.9

Guidance Center, 101

Gymnasiums

- Elementary, 56.1–56.45
- Secondary, 87.1–87.33

Handicapped Children, Facilities

- Cardiac, 59.5
- Crippled children, 59.4
- Emotionally disturbed, 59.7
- Hearing defects, 59.2
- Mentally retarded, educable, 59.6
- Mentally retarded, trainable, 59.62
- Remedial center, reading, speech correction, 54
- Speech correction rooms, 59.3
- Visually handicapped, 59.1

Handrails, 124.6

Hardware, 125.5

Handwashing Facilities, 217.2, 218.1

- Food service area, 105.445 b.

Health Education Facilities. See PHYSICAL AND HEALTH EDUCATION

Health Guidance Center, 102

- Floor areas, service spaces, 102.4

Heating and Ventilating

- Boiler and heating equipment rooms, 242
- Central fan system and controls, 247.1
- Chart: major occupied spaces
  - Air changes, 241.1
  - Minimum outside air, 241.1

INDEX

Section or Subsection

- Exhaust air, 241.1
- Temperature at thermostat, 241.1
- Controls, 235, 244, 248
- Design standards, references, 233
- Ducts, dampers, vent duct termination, 251
- Exhaust systems:
  - Chlorine tank storage rooms, 252.8
  - Corridors, 241.4
  - Fume hoods, 252.3
  - Garages, 252.6
  - Hoods, shop: forge, welding, soldering, 252.7
  - Industrial commission, 252.2
  - Kitchen systems, 252.4, 252.41
  - Paint spray booths, 252.5
  - Rooms requiring independent exhaust, 252.1
- Fans and blowers
  - Air changes, outside air, 241.1
  - Air velocities, 250.7
  - Maximum room inlet temperature, 250.6
  - Recirculated air, 250.52
  - Tempered air, 250.53
- Firing equipment and safety devices, 244
  - Boilers, unfired pressure vessels, 244.1
  - Direct fired gas classroom units, restrictions, 244.5
  - Forced warm air systems, 244.4
- Fuel storage and handling, 243
- Heat pump and air conditioning systems, 247.2
- Heating units, 246
  - Electric panels, 246.4
  - Radiators and convectors, 246.1
  - Unit heaters, 246.3
  - Unit ventilators, 246.2
- Indicator panels, 248.5
- Manual of instructions, 239
- Mechanical engineer, responsibility and signature, 231, 253
- Performance tests, 238
- Plans and specifications, 237
- Piping, 245
- Systems and selections, 234–236
- Thermal environment, 230

Home Economics Facilities
- Department, suggested floor space:
  - One teacher, 84.41
  - Two teacher, 84.42
  - Three teacher, 84.43
- Equipment, principal work centers, 84.5

Incinerators, 133, 250.27

Indicator Panels, 110.23, 248.5

Individual Study Areas, 70.4, 70.5, 71.4, 72.01

Industrial Arts, 79
- Auxiliary areas, 79.53
- Equipment arrangement, 79.6
- Mechanical, electrical services, 79.8
- Teaching stations, 79.2
- Types of shops, floor areas, 79.4–79.52

Inspection
- During construction period, 26.1, 157, 238, 270

Section or Subsection

- Final, 26.3
- Within guarantee period, after completion, 29.0 Annotation

Inspector, Resident Building, 25.4, 26.1

Instructional Materials Center
- Elementary School, 52–53
- Secondary school, 72–73

Instrument Rooms
- Repair, 78.33
- Storage, 55.4, 78.32

Insulation, Sound Control, 170–178

Interchangeable Classrooms. See GENERAL PURPOSE CLASSROOMS

Intercommunications Systems, 100.27, 267.2, 267.6

Janitor's Facilities. See CUSTODIAL FACILITIES

Junior High School Science
- Program, 75.13–75.15
- Classroom-lab., 75.16, 75.21

Kindergarten Classrooms, 51.21–51.24

Kitchens, 105.44. Also see MULTIPURPOSE ROOMS, 57

Laboratories
- Agriculture, 81.3, 81.34
- Art, 77
- Business education, 82
- Home economics, 84
- Industrial arts, 79
- Mathematics, 76
- Modern foreign language, 74
- Science, 75
- Vocational, 80, 85, 86

Landings, Stairs, 124.5

Landscaping
- Architect, 43.2 d.
- Site development, 43.2 a., b., c.

Language Laboratories
- Electrical service, 74.28
- Electronic classroom, 74.3
- Equipment, 74.23, 74.28
- General classroom with some lab positions, 74.1–74.17
- Language laboratory, 74.2–74.29
- Maintenance, 74.4
- Office and work area, 74.29 h.
- Projection room, 74.29 g.
- Recording room, 74.29 f.
- Sound control, 74.26, 74.27, 74.29 a.-d.
- Storage, 74.29 e.
- Ventilation, 74.29a.

Laundry
- Home economics center, 84.54
- Physical education unit, 87.43

Lavatories, 217.2–217.28
- Heights, 218.1

INDEX

Section or Subsection

Lawns, 43.2

Legal Counsel, 20.c, 24.3, 25.3

Librarian, 52.6, 72.8

Library Center, Elementary School. See also INSTRUCTIONAL MATERIALS CENTER
- Conference room, 52.5
- Office, librarian, 52.6
- Reading room, 52.3
  - Standards for, 52.32 a.
- Work area, 52.4

Library Center, Secondary School. See also INSTRUCTIONAL MATERIALS CENTER
- Conference room(s), 72.6
- Office, 72.8
- Periodical storage room, 72.5
- Preview and listening room, 72.7
- Professional library and teacher's research room, 72.9
- Reading room, 72.3
  - Standards for, 72.32 Table 1
- Work storage room, 72.4

Lightening Protection, Smoke Stacks, 135.5

Lighting, 190–209
- Brightness, 193, 194
- Brightness differences, limits, 193.2
- Daylight controls, 196.2
- Dimmers, 194.8
- Exit, 125.94
- Footcandle levels, building spaces, 193.3
- Lighting systems, 194
- Luminaires, 194.4
- Reflection factors, 193.4, 194.2
- Scissors curve, 194.1
- Stages, 57.3 e., 106.77
- Windows, 197
  - Glass area, 197.1
- Windowless classrooms, 198

Loads, Structural Design, 154

Location
- Building centers or areas. See each type of room or facility.
- Sites, 40, 41, 43

Locker and Lounge Facilities
- Custodial employees, 110.42 f.
- Food service employees, 105.49
- Teachers, 103.3

Lockers, Clothing Storage, 51.32 b., 71.6 i.

Luminaires
- Brightness guide, scissors curve, 194.1
- Fluorescent types, 194.41
- Footcandles vs. watts per sq. ft., chart, 194.3
- Heights, suspended fixtures
- Incandescent types, 194.42
- Sound ratings, fluorescent ballast, 194.7

Map and Chart Rails, 51.23, 51.33, 71.6 c.

Maps, Site Selection, 40.6

Master Site Plan, 43.2

Section or Subsection

Materials Center. See INSTRUCTIONAL MATERIALS CENTER

Mirrors, 216.47, 84.52

Motion Pictures, 53.3, 57.5, 73.4, 74.29 g., 74.32

Multipurpose Rooms and Areas
- Auditoriums, 106.1
- Business education, 82.37
- Conference room, 104.12
- Elementary school, 57
- Food service, 105.471 b.
- Gymnasium-auditorium, 87.8
- Instructional materials center, 52–53, 72–73
- Music room, 78.23, 78.4
- Physical education, 87.1, 87.91
- Science, 72.25
- Secondary schools, 70.4, 70.5
- Swimming pool, 87.344

Multistory Buildings
- Construction requirements, 122.2
- Elevators, 136.0, 261.0
- Storage facilities, 110.41

Music Rooms
- Acoustical treatment, 78.54, 178.2
- Choral rooms, 78.22
- Instrumental rooms, 78.21, 78.23
- Music library, 78.35
- Practice rooms, 78.31
- Storage
  - Instrument, 78.32
  - Uniforms, robes, 78.34

National Board of Fire Underwriters, 136, 233

National Electric Code, 136, 233, 261

National Fire Protection Ass'n, 121, 233

Noise Reduction, 176–178

Obstructions
- Corridors, 126.4
- Gymnasiums, 56.32

Offices
- Administrative, 100.23, 100.3
- Audio-visual education, 73.32, 73.7
- Elementary school, 100.13, 100.23, 100.3
- Food service area, 105.48
- Guidance center, 101.2, 101.22
- Gymnasiums, 56.42, 87.46
- Health center, 102.33, 102.4
- Music library, 72.8
- Principal's, 100.23, 100.3
- Superintendent's, 100.23, 100.3
- Teaching personnel, 71.4
- Vault, 100.26

Outdoor Facilities
- Physical education, 56.5, 87.9
- Site planning, 43.6

Outlets, Electrical, 264–264.5. Also see each type of facility.

INDEX

Section or Subsection

Outside Air, Quantity of, 241.1

Painting and Finishing Rooms, 79.53, 79.56, 134.5, 134.6

Panel Heating, 234.5, 245.4

Partitions, Dividers
- Auditorium, 106.1
- Classrooms, 51.12c., 70.4–70.5
- Gymnasiums, 87.32 a.
- Power operated, Industrial Commission, 272

Paved Areas
- Parking, 43.53, 43.56
- Physical ed., 56.51a., 56.52, 87.92a., 87.94

Performance Tests, Mechanical Equipment
- During construction, 238
- During guarantee period, 29 Annotation

Parents Rooms, 104.3

Parking, 43.54–43.57

Physical and Health Education
- Gymnasiums, 56.21–56.39, 87.31–87.33
- Gymnasium-auditoriums, 106.9
- Health classroom, 87.35
- Locker and shower rooms, 56.41, 87.41, 87.42
- Multipurpose rooms, 57
- Offices, 87.46
- Outdoor facilities, 56.5, 87.9
- Site planning, 43.6–43.7
- Swimming pool, 87.34
- Team service areas, 87.5

Physics Laboratories, 75.24

Piping, Steam and Hot Water, 245

Planning Roles
- Architect, 22, 23, 25–27
- Board, local, 7.2
- Bond consultant, 24.2, 24.6
- Contractor, 26
- Engineer, 22
- Landscape architect, 43.2
- Lay citizen, 24.4
- Legal counsel, 20 c., 24.3, 25.3
- State school plant planning section, 5.–5.54, 21.5, 25.1 e.
- Superintendent, 7.1

Planning School Buildings, Procedures
- Architect and engineer, selecting, 22
- Certificate of completion, 5.54
- Construction of building, 26
- Contract agreement, 28
- Determining educational needs, 21
- Final plans and specifications, 25
- Financing the building program, 24
- Preliminary and planning phase, 23
- Putting the building into service, 27

Plans and Specifications
- Approval by Dept. of Ed.
  - State board regulations, 3.1
  - School plant planning section, 4.0–5.54, 25. e.

Section or Subsection

  - Statutory authority, 3.0
- Development of, 23, 25
- Preparation of 280–289

Plumbing and Sanitary Facilities
- Building gas service lines, 215
- Certificate of inspection, 220
- Design, responsibility, 212
  - Signature of responsible person, 219
- Plumbing code and standards, 211
- Plumbing fixtures and trim, 217
  - Heights, 218
- Sewage and waste disposal, 214
- Toilet rooms, 216
- Water supply, 213

Power Lines, Electric, 262.2, 262.21

Practice Rooms, 78.31

Presentation of Building, 7.1 (20)

Principal's Office, 100.23, 100.3

Public Address System, 100.27, 267

Public Use Facilities
- Site planning, 41.2, 43.7
- Telephones, 100.28, 106.4
- Toilets, 57.1 d., 106.8, 216.35

Radiant Heating, 234.5, 245.4

Radiation, Direct, 234.1, 246.1

Radio Equipment, 53.5 (9), 73.4 a. (11)

Rails, Stair, 124.6

Ramps, 59.03, 59.42, 124.51

Reading Rooms
- Elementary, 52.3, 52.32 a.
  - Remedial, 54
- Secondary, 72.3, 72.32 Table 1

Receptacles, Electric, 264–264.5. Also see each type of facility.

Reception Area
- Administration unit, 100.21, 100.23 f., 100.3
- Guidance center, 101.2, 101.21
- Health center, 102.31, 102.41

Regulations, State Board of Ed.
- Buildings, 3.1, 3.2
- Sites, 3.1

Recreational Areas, 43.7, 56.52, 87.91–87.95

Refrigerated Storage, 105.442

Remedial Rooms
- Reading and speech correction, 54
- Physical education, 87.321

Resource Centers. See INSTRUCTIONAL MATERIALS CENTERS

Rest Rooms, 102.34, 102.41, 103.3, 216

INDEX

Section or Subsection

Risers, Stairways, 124.4

Robe and Uniform Storage, 78.34

Safety, Fire and Life
  Disaster shelter, 105.55, 156, 198.2
  Electrical service, 262–262.56
  Fire. See Fire Marshal's Building Standards
  Heating and ventilating, 242–248
  Shops, 79.6
  Science, 75.23, 75.51–75.52
  Structural design loads, 154

Sanitary Fixtures and Trim. See Plumbing and Sanitary Facilities

School Boards, Planning Role, 7.2

School Lunch Facilities, Elementary, 58

School Lunch Facilities, Secondary, 105. Also see Food Service Facilities

School Plant Planning Section, State
  Approval, plans, 5.5, 25.1 e.
  Approval, sites, 5.4, 40.5
  Preliminary conference, 21.5 b.
  Services, 5.1–5.5

Science Facilities
  Biology, 75.13–75.16, 75.22
  Chemistry, 75.13–75.16, 75.23
  Junior High, 75.13–75.16, 75.21
  Multipurpose, 75.13–75.16, 75.25
  Physics, 75.13–75.16, 75.24
  Auxiliary facilities, 75.3
  Other detail
    Electrical, 75.23
    Floors, 75.56
    Plumbing, 75.51
    Ventilation, 75.52

Scissors Curve, 194.1

Screens, Projection
  Auditorium, 106.58
  A-v equipment storage, 53.5, 73.4 a. (13)
  Classrooms, 51.33 b. (2), 73.1 a.
  Language labs., 74.18, 74.23 c.

Seating. See Desks, Seating

Self-contained Classrooms, 51.31–51.34

Secondary Schools
  Agriculture, 81
  Area vocational-technical, 85
  Art rooms, 77
  Bus garages, 111
  Business education, 82
  Capacity, pupils, 70.12
  Central and auxiliary facilities:
    Administrative unit, 100
    Guidance center, 101
    Health center, 102
    Auditoriums, stages, 106
    School lunch, 105
    Teachers rooms, 103

Section or Subsection

  Classrooms, general, 71
  Cooperative training program, 86
  Distributive education, 83
  Driver education, 88
  Foreign language rooms, 74
  Home economics, 84
  Instructional materials center, 72–73
    Audio-visual education, 73
    Library, 72
  Industrial arts, 79
  Mathematics lab, 76
  Music unit, 78
  Physical and health education, 87
  Planning procedures, 1–39
  Science facilities, 75
  Safety, health and engineering
    Electrical design, installation, 260–269
    Fire and life safety, 120–149
    Heating, ventilating, 230–259
    Lighting, fenestration, 190–209
    Plans and spec., 280–289
    Plumbing, sanitary fixtures, 210–229
    Sound control (acoustics), 170–189
    Structural design, 150–169
  Service facilities
    Custodial, 110.4
    Mechanical equipment, 110–110.32
  Swimming pools, 87.34
  Toilet rooms, 216.26–281.1
  Trade and industrial, 80

Service Facilities
  Custodial, 110.4
  Electrical, 260–279
  Gas, 41.5, 132, 243.2
  Mechanical equipment, 230–259, 110–110.32
  Sanitary services, fixtures, 210–229

Sewage Disposal, 214

Shades, Drapes, 135.1, 196.2

Shelving
  A-v ed. equipment, 73.8 d. (1)
  Library, 52.32 a., 72.32 Table 1, 72.331
  School lunch, dry storage, 105.421 b.

Shops
  Agriculture, 81.35
  Area vocational, 85
  Industrial arts, 79.5
  Trade and industry, 80.3

Showers
  Gym units, 56.41, 87.42
  Plumbing, 217.7, 218.1

Signaling Systems, 100.27–100.28, 267.1–267.6

Signature, Plans, 6.5 b., 158, 153, 268, 281.1

Sinks, 217.4–217.51, 218.1 Notes (1)

Sites
  Approval, state, 40.5
  Site development, 43
  Site selection, criteria, 40, 41
  Size of sites, 42

INDEX

Section or Subsection

- **Sizes**
  - Building spaces, See each type of facility
  - School size, elementary, 50.3, 50.31
    - Secondary, 70.12
  - Site size, 42.3–42.5
- **Soil Borings**, 41.63, 153, 281.2 1.
- **Solar Control**, 196,230
- **Sound Control**, 170–189
  - Sound proofing, 174–178
- **Special Education Facilities**, 59
- **Specifications**
  - Building construction, 282
    - Approval of, 3.0, 5.5, 25.1 e.
  - Educational, 23.2
- **Speech and Hearing Correction Area**, 54, 59.2, 59.3
- **Stages**, 57.3–57.31, 106.7–106.79
- **Stairways**, 124
- **State Agencies**
  - Board of education, 4
  - Board of electricity, 6.4
  - Board of registration, architects and engineers, 6.5
  - Department of education, 4
    - School plant planning section, 5
  - Department of health, 6.1
  - Department of labor and industry, 6.3
  - State fire marshal, 6.2
- **Storage**
  - Auditorium, 57.24, 106.79, 106.9
  - Bicycle, 43.57
  - Classroom, 51.22, 51.33 f., 71.6 f.
  - Clothing, personal, 51.22 c., 51.32 b., 71.6 i.
  - Custodial, 110. 41
  - Food service, 105.42, 105.442
  - Gymnasiums, 56.43, 56.44, 87.44, 87.52
  - Home economics, 84.4, 84.5
  - Instructional materials center
    - A-V ed. equipment, 53.3–53.5, 73.4–73.5
    - Library, 52.4, 72.4
  - Lockers, phy. ed., 56.41, 87.41
  - Music room, 55.4, 78.32, 78.34
  - Office, 100.26
  - Outside equipment, 110.44
  - Portable units, 51.1, 53.5
  - Pupil records, 101.24
  - Science labs., 75.2–75.3
  - Shops, 79.53–79.55, 81.35
  - Stage, 57.3 f., 106.79, 106.9
  - Texts, supplies, 100.26, 101.25, 102.35
  - Tools, 79.54, 81.35
  - Vault, 100.26
- **Structural Safety**
  - Codes, local, 151
  - Design data to be scheduled, 155
  - Design loads, 154
  - Design standards, 152

Section

  - Inspection during construction, 157
  - Soil borings, 153
- **Student Activity Rooms**, 104
- **Study Area**, 70.5 e., 70.7, 70.8, 72.01, 74.22
- **Superintendent of Schools**, 7.1
- **Swimming Pools**
  - Design, 87.345
  - Electrical standards, 271
  - General features, 87.341–87.344
  - Guide lines, 87.345 i. (11)
- **Switches, Electrical**, 263.2
  - Power operated partitions and dividers, 272
- **Surveys**, 21.3
- **Tackboards**
  - Classrooms, general, 51.23 b., 51.33 b., 71.6 b.
  - Specialized rooms. See each type of facility.
- **Teachers**
  - Lounges or rest rooms, 103.3
  - Personal storage, 51.21 g., 51.33 f., 71.6
  - Toilets, 216.25, 216.34 a., c.
  - Workrooms, 72.01, 72.9, 73.6, 103.2
- **Teaching Stations**
  - Agriculture, 81.2
  - Art, 77.2
  - Business education, 82.2
  - General classrooms, 70.6
  - Home economics, 84.4
  - Industrial arts, 79.2
  - Language lab., 74.24
  - Music, 78.14
  - Physical ed., 87.2
  - Science, 75.16
- **Team Rooms**, 87.5
- **Team Teaching**, 50.1, 51.1, 51.12, 70.4, 70.5
- **Telephone**, 100.27, 100.28, 267.21, 267.22
- **Television**, 73.32, 73.4, 73.7 c., 73.8 (7), 75.22, 100.27, 106.78, 267.6
- **Temperature Controls**, 235, 248, 248.5
- **Temperatures, Design**, 240, 241.1
- **Thermal Environment**, 230
- **Thermostats**, 248.4
- **Toilet Rooms**
  - Custodial, 110.42
  - Elementary School, 216.2–216.37, 216.4
  - Fixtures and quantity, 217, 218
  - Food service employees, 105.491
  - Physically handicapped, 59.03, 59.43
  - Public, 57.1 d, 106.8, 216.35
  - Secondary school, 216.3–216.35, 216.4
  - Staff, private, 100.25, 102.34, 102.4, 103.4, 216.25, 216.34
  - Ventilation, 241.1, 241.4, 252.1

INDEX

Section or Subsection

Towel Service Rooms, 87.43

Typewriting Rooms, 82.3, 82.33, 82.34, 82.4

Unit Heaters, 246.3
  Direct fired gas, 244.5

Unit Ventilators, 234.2, 246.2

Urinals, 217.3, 218.1

Utilities
  Electricity, 262
  Gas, 132, 215
  Planning sites, 415–41.52
  Standards, codes, 211, 233, 261
  Sewage disposal, 214
  Telephone, 267.21, 267.22
  Water, 213

Vaults, 100.26

Ventilation. See HEATING AND VENTILATION.

Visually Handicapped, 59.1

Visual Environment, 190–199

Visual Tasks, 192.2, 193.2

Vocational Education Areas
  Area vocational-tech schools, 85
  Secondary schools
    Agriculture, 81
    Business education, 82
    Cooperative training program, 86
    Distributive education, 83
    Home economics, 84
    Trade and industrial, 80

Walks and Drives, 43.52–43.55

Walls, Wall Spaces
  Elementary classroom, 51.33
  Kindergarten classroom, 51.23
  Movable, 71.3 b., c.
  Reflectances, 193.4–193.42

Section or Subsection

  Secondary classrooms, 70.5, 71.6a.–d.
  Specialized rooms, See each type of room or facility.

Wardrobes
  Pupils, 51.22b., 51.32b.
  Teachers, 51.21 g., 51.33 f. (1), 71.6 e.
  Uniforms and robes, music unit, 78.34

Warm Air Furnace Systems, 234.6, 244.4

Water Closets, 217.1, 218.1

Water Supply, 213
  Hot water temperatures, 213.3, 213.4
  State board of health, 6.1, 213.14

Windows
  Frame materials, types, 197.2
  Glass area, limits, 197.1 a.b.c.
  Gymnasiums, locker rooms, 197.5
  Height of sills, 197.3
    Agriculture shops, 81.35 g.
    Industrial arts shops, 79.74
  Instructional spaces, 197.4a
  Kitchen and storerooms, 197.7

Windowless Classrooms, 198

Wiring, Electric, Standards, 261–272
  Power operated room dividers, 272
  Swimming pools, 271

Work Counters. See COUNTERS

Work Sinks, 217.4–217.51, 218.1 Notes (1)

Working Drawings, 5, 6, 25.1, 280–281.7

Workshops
  Custodial, 110.23 b., 110.41 e.
  Research, advanced project area
    Mathematics laboratory, 76.2 c.d.
    Science, 75.3 (3)
  Seminar groups, 70.4 b.

Zoning
  Heating and ventilating, 235. b., 248.2, 250.91
  Site information, 40.6, 41.2